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Where Does the Money Go?

In the "American Machinist," No. 16, under the head of "Technical Publications," we spoke in commendation of a little pamphlet bearing the above title. It is not, properly speaking, a technical publication, and through its being so classified a wrong impression of it may have been conveyed to some of our readers. We are convinced that it has not yet had a sufficiently extended circulation, nor become as well known and appreciated as it should be, and we may be pardoned for calling attention to it again. We do not wish to be misunderstood. The pamphlet is absolutely and exclusively and professedly an *ex parte* statement. It is devoted entirely, without looking either to the right or to the left, to the presentation of the side of the shop proprietor or the employer. It aims to correct the idea assumed to be held by workmen that proprietors generally get more than their just share of the profits of business, and this it does by enumerating as exhaustively as possible all the details of expense involved in the conducting of a manufacturing establishment, and in the production in quantity of any article of value, beyond the two principal items of material and labor. It shows that these items of expense are numerous and that in combination they form a large percentage of the cost account. So far as this presentation is of value, it is so almost exclusively to the other side. This little pamphlet is one pre-eminently for the employed class to read, and we hope that, either through their own efforts or by gratuitous distribution by employers, it will be widely read and studied.

Nothing, of course, is settled by it. It is not at all improbable that the employers are just as much in the wrong in some of their ideas of their workmen, and if so there is nothing so important as for them to find it out. The trouble is that both employers and employed talk their grievances among themselves, where they can do no good, instead of talking them to the other side. One of the most encouraging signs of the times is in the disposition on both sides to arbitrate and discuss grievances and misunderstandings. The trouble still is that mutual understandings instead of misunderstandings are not arrived at as soon as they should be, and discomfort and loss results all around. We believe in not only free discussion, but in full discussion. Things are never permanently settled until they are settled clear down to the foundation. Therefore it is that each side should make to the other the fullest and the strongest presentation of its case.

"Where Does the Money Go?" does not suggest or invite discussion. What it states is practically incontrovertible; but it deals with but one of many factors of a vast and intricate problem. There are others quite as important and not so easily and comprehensively presentable. Nevertheless they are to be considered, and for each there is a complete solution and an equitable adjustment, but there can be no permanent adjustment until there is first the fullest understanding.

The First T-Rail.

Stevens Institute of Technology, in Hoboken, N. J., has held its early prestige among engineering schools, and has kept up the equipment necessary thereto, in spite of cramped space and resources which seem almost ridiculous compared with the facilities enjoyed by some institutions of recent growth under State aid or heavy endowment. For several years the alumni have been raising a $50,000 fund to put up an additional building. This now amounts to $53,000, a substantial portion having been contributed by President Henry Morton, but in the meantime the cost of materials has so much advanced that the funds are inadequate, and the erection has been postponed for a year or so in hope of a decline. A few months ago Andrew Carnegie gave $50,000 for another building, and when he learned that for the same cause this would also have to wait he added $15,000 to compensate for the increased cost, so the contracts have been awarded and work has already commenced. There will also be constructed for the group of buildings a power house which will cost about $12,000, and which will be the personal gift of President Morton, whose donations for the equipment of the Institute have been numerous and liberal.

As a token of appreciation for Mr. Carnegie it has been decided to present him with a section of an original 36-pound T-rail from the Camden & Amboy Railroad, enclosed in a suitable receptacle. At the alumni meeting, June 13, Dr. Morton gave a history of this rail, substantially as follows:

The rails for the Camden & Amboy track between South Amboy and Bordentown, N. J., were rolled in 1831, and were the first T-rails designed or made, although the Vignoles rails produced in France several years later have generally been credited with being the earliest. The former were designed by Robert L. Stevens, who was sent to England to have them made, there being in this country no mill capable of doing the work. Arrived in England, he called for bids on the job from various iron works, but at first none of them dared to undertake it. After a while he persuaded Mr., subsequently Sir, John Guest, owner of a Welsh mill, to attempt it, not, however, before guarantees had been given against damage to the machinery in performing the mighty task of rolling a 36-pound rail. Mr. Stevens personally directed the work. When the first rails that came through were crooked and twisted the workmen hailed it as proof that the attempt was futile. Mr. Stevens told them to take their hammers while the iron was hot and straighten it out. Finally the rails were satisfactorily completed. They were sent to America in a good

many different vessels, a few tons at a time, for they were regarded as a perilous sort of freight. Dr. Morton has fac similes of letters, specifications and bills connected with this matter, which are to be inclosed in the silver box which is to contain the section of rail, and which is being made by Messrs. Tiffany & Co. On the top of this box will be figures in relief showing the rolling of the rail through a typical early mill. On opposite sides will be depicted the first train of the Camden & Amboy Railroad—preceded by an outrider to keep people off the track—and a view of the proposed Carnegie Laboratory. The ends will contain medallion portraits of Robert L. Stevens and Mr. Carnegie. At the four corners will stand figures embodying Stevens Institute's conception of the evolution of the ideal modern engineer—a primitive iron worker, a mediæval armorer, an old-fashioned blacksmith, and one of its own graduates.

Examinations for Draftsmen.

The United States Civil Service Commission will hold examinations July 10, 11, 1900, in any city where it has a local board of examiners, for draftsmen for the following classes of service: Structural steel, architectural and structural steel, general land office. Persons who desire to compete should at once apply to the United States Civil Service Commission, Washington, D. C., for application forms 304 and 375, which should be properly executed and promptly filed with the Commission.

Personal.

Robert S. Brown, engineer of the New Britain Machine Company, sailed for Europe June 16. He expects to be gone about two months, on business and pleasure combined, and will visit England and Germany, in addition to the Paris Exposition.

Obituary.

Horace C. Disston, president of the Henry Disston & Sons' Iron and Steel Works, and vice-president of the Henry Disston & Sons' Saw Works, died June 13, forty-six years old. He was a son of Henry Disston, the founder of the largest saw and file manufactory in this country. Horace entered his father's works in his seventeenth year, and learned the general saw business. Then he went into the steel department, eventually becoming its manager, and finally its president.

Technical Publication.

"A Practical Treatise on Gearing," Sixth Edition. Providence, R. I., Brown & Sharpe Manufacturing Company. 158 pages, 9¼x6 inches, 71 cuts. Price, $1.

This new edition of this familiar and valuable handbook for the shop man is greatly improved typographically throughout, and enlarged by the addition of much valuable matter, especially embodying all the later developments in bevel gear and in worm gear practice.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(14) "I Think Not," Bridgeport, Conn., asks: In worm gearing, is the pitch of a double-thread worm the same as the lead? A.—Properly speaking, the pitch of a screw or worm is the distance between consecutive threads, while the lead is the distance from a given point in one thread to the same point in the next turn of the same thread. In other words, in a single-thread worm the pitch and lead are the same, while in a double-thread worm the lead is twice the pitch. The above usage of terms is in accordance with the practice of the Brown & Sharpe Manufacturing Company, and is fairly general. The term "lead" is almost universally used as above, but the usage of the term "pitch" is not so well defined, and where that term is used in connection with double-thread worms some uncertainty is liable to arise. With such worms the use of the term "lead" is therefore preferable.

(15) H. L. B., Cincinnati, O., says: We have two planers working on the same class of work and under exactly the same conditions, one being geared in a ratio of 40 to 1 and the other geared in the ratio of 80 to 1, both cutting at the rate of 20 feet per minute. Please state the ratio of the horse-powers required to run them, and also state whether there will be any variation in this ratio when taken at the driving pulley shaft or at the countershaft? A.—The pulleys and their shafts, running at a higher speed in the second case than in the first, their bearings would doubtless absorb slightly more power in friction. It is now well known that the effort required to reverse the motion of a planer is chiefly used in stopping and reversing the pulleys, and not the table. This being so, the highly geared machine would absorb considerably more power than its mate at the moment of reversal, though how much more it is impossible for us to say. Except for these considerations, there would be no difference in the power consumed by the two machines, and this regardless of where it is measured.

Inquiries for Machinery.

(125) Wanted names of manufacturers of machines for casting lead seals such as are used to seal railway cars or cans.

(126) Names of manufacturers of machines for making needles for knitting and sewing machines.

Commercial Review.

NEW YORK, Saturday, June 16.

ENGINES AND OTHER MACHINERY.

Engine builders are faring better than some of their brother manufacturers of engineering materials, and in the case of one Middle Western maker of Corliss engines deliveries are longer than they were two months ago. Engines, in truth, are less susceptible than some of the cruder products to the steel market influences which affect demand by impugning the stability of prices. Engine values seem generally to be solid, though some cutting on bids is reported, as might be expected just now. Boilers are more under the sway of the steel market, but the leading water-tube concerns are very busy with orders on hand. Fire-tube boilers have been more generally and greatly affected in price by the material market than water tubular ones have, since tubes have not yet fallen in the way that plates have done.

Regarding rumors current of negotiations for the absorption of the Pratt & Whitney Company by the Niles-Bement-Pond Company, we can say that, while it is true there have been negotiations looking to a union of those two companies, the matter has not at this writing been closed up in fact, as it has been in the more radical street gossip, and the outcome appears to be doubtful.

Orders for machinery to put in working order the collieries damaged by the Boers at Dundee have already been given to London firms.

The value of mining machinery in the Transvaal is said to be about $47,000,000.

Speaking of the South African prospects, the New York manager for a British house importing American machinery is of opinion that the financing of enterprises in the mines will be somewhat retarded until it is determined what the British Government is going to do about a war indemnity. He thinks quite possible that there may be levied an assessment upon the land in the Dutch states amounting to, say, 20 per cent. of its value. The mine-owners would then have to pay upon the land they own, although probably not upon their improvements. It is said also that Sir Alfred Milner is advising the refugees from the Transvaal not to be in a great hurry to return.

The Hooven, Owens & Rentschler Company is sending to Japan seven engines of several hundred horse-power each. They have sold, among others, a 600 horse-power engine to J. G. White & Co. for the Toledo (Ohio) and Monroe Beach railway.

J. W. Duntley, president of the Chicago Pneumatic Tool Company, is in New York for a few days between his last European trip and his next, and has a good many interesting things to say about his adventures in pursuit of orders. He was in St. Petersburg for ten days giving exhibitions

of tools three times daily. In Germany he enjoyed a tête-a-tête with Emperor William while the latter was inspecting his navy yards and war ships. William tried his own royal hand at operating one of the tools, and remarked: "Now I'll go and get some lunch, then come back and use the tool some more. It's good for the digestion." Mr. Duntley secured several excellent snapshot photos of his majesty inspecting the docks. King Oscar of Sweden also recently manipulated one of the calking machines, but Mr. Duntley was not there at the time to see, although he visited Sweden during his trip.

Mr. Duntley says he would rather have the foreign market for pneumatic tools two years hence than the domestic. Foreigners are taking hold of them in a way that belies their traditional conservatism. Where an American railroad would put three or four tools in its shop a European one, as soon as it becomes convinced of their advantage, will buy six or eight. The tools are considered economical even where labor is cheap, because they multiply the productiveness of the labor.

When Mr. Duntley was abroad a year or two ago he advocated the home construction of air compressors in Germany, believing that since they were poorly provided with facilities for operating pneumatic tools there it was expedient to encourage effort along this line. Subsequently he finds that the compressors they build after having American plans furnished are unable to compete in cheapness with American, which can be delivered in Germany, allowing a handsome profit, for 20 per cent. less than the German. This is attributed in part to the fact that the German manufacturers are dissatisfied with some of the dimensions of the American compressors, considering them too light, and insist upon doubling a measurement here and there. The New York Air Compressor Company, which has lately been started in connection with the Chicago Pneumatic Tool Company's business, cannot meet the demand for compressors to drive the latter's tools, and about twelve compressors a month have to be built by contract in outside shops. Mr. Duntley expects eventually to found a plant in Europe for the manufacture of pneumatic tools.

A few statistics of the business of his concern given by Mr. Duntley are as follows: The St. Louis shops are running day and night, and with the company's other shops and that of the New York Air Compressor Company, employ some 450 men, which number will be raised to about 1,000 when those at Detroit are in operation. Yet the company is between four and five months behind with orders. In the last three months about 3,000 tools have been ordered from Europe. (This includes the Russian navy yard contract.) The company has received orders for the equipment of thirty European shipyards. There are about 350 shipyards in Europe, all told. Sales at the Paris Exposition this year are expected to reach $500,000. Shipments to Japan average two lots a month. Four orders have been filled for China. The domestic demand is ruling over 800 tools a month. An order came June 15 for over 200 tools, amounting to some $45,000, for the Cramp Ship and Engine Building Company, which has about 700 now in use. It has been figured that the Chicago Pneumatic Tool Company's long-stroke hammers already made could put a row of rivets one foot apart around the earth in a day.

British shipyards did not seem to Mr. Duntley quite so active as the American are at present. Business in England and Scotland, he believes, has set in for a protracted period of ordinary healthful conditions. German trade was pronounced by a leading Berlin authority on machinery as tending to become rather quiet. Mr. Duntley agrees that the most promising outlook for future trade is in Russia. The Swedes also are adopting pneumatic tools with avidity.

It is noteworthy that some of the earliest pneumatic hammers—which were valveless—were made in Scotland and exhibited at the Chicago World's Fair. The British did not develop the pneumatic idea, but are now dependent upon Americans for their tools.

The Pittsburgh Machine Tool Company reports a demand for its tools highly gratifying to a concern so recently started. The shop in Allegheny is almost fully equipped, the latest additions being a steam hammer and a Warner and Swasey turret lathe. The large planer which the company has had to build for itself, owing to the late scarcity of planers and the long delivery of the standard manufacturers, is about ready to set up. When it is in position the shop will be in readiness to take in hand the complete line of lathes and planers formerly manufactured by the Gleason Tool Company of Rochester. Among the recent shipments of lathes made by the Pittsburgh Machine Tool Company are one 38-inch by 14-foot bed and one 32-inch by 30-foot bed to the Illinois Steel Company, Chicago; one 32-inch by 18-foot bed to the Bellaire Steel Company, of Bellaire, Ohio; one of similar size to the Erie Foundry Company, of Erie, Pa.; two 38-inch lathes, 18 and 22-foot beds, to the U. Baird Machinery Company, of Pittsburgh, and one 32-inch chucking lathe to W. E. Johnson & Co., of Buffalo; and these are only a few of the orders completed and in hand. The location of this shop, in the place where iron and steel grow wild, is proving the wisdom of the selection.

CINCINNATI REPORT.

In the Cincinnati machinery market there are varied evidences of unusual conditions for this time of year. The market is now about normal, however, taking into consideration the general average since the first of the year. One of the larger machine tool manufacturing concerns here, in answer to a query as to the output and demand compared with the same period of 1899, said: February was off one-third, March and April in excess about 20 per cent., May decidedly off, and June, up to the middle of the month, about normal. These comparisons with reference to the company's full capacity referred to orders received. Foreign trade in machine tool manufacturing centers is quiet. The domestic demand is now much the better of the two. A number of the concerns which started in during the rush and which, presumably, depended upon one or possibly two agents for their entire business, now that these agents are getting all that they require from their old-established connections, are probably suffering for orders. Among the larger machine tool manufacturers there is no visible evidence of limited demand, but among the makers of medium sized standard tools and smaller miscellaneous ones the market is comparatively quiet. The E. A. Kinsey Company, jobbers, referred to the week just closed as the first since the opening of the year that the demand was weak. In their special machinery department orders are firm and market conditions reported as improving. Among the electrical concerns the demand for the better grades of power machinery is growing in no uncertain measure.

Phillip J. Roeder, of Mexico City, has spent several days in the city buying some special grades of tools.

There is a feeling among boiler manufacturers that they are just on the eve of a prosperous season. There has been plenty of inquiry, but the general delay, waiting for prices of material to drop, has brought about a condition of gradually losing strength in the market. Foundry men are asking an increase in wages, and the output in that line is comparatively quiet. A number of Cincinnati molders have been in Detroit discussing their demand for 25 cents per day advance in wages. On May 1 the foundry men here granted their men a raise of 10 cents a day until June 1. Bench molders in Cincinnati, Cleveland and Chicago were getting $2.50 per day and floor molders $2.75 when the demand for an increase was first made. The E. A. Kinsey Company referred to before in this letter is putting in a line of electrically driven iron working machinery, in recognition of a constantly increasing demand for such goods.

CHICAGO MACHINERY MARKET.

Large agricultural implement works are closing down for the summer somewhat earlier than usual. Machine shops generally have not the orders piled up ahead that were on their books a few months ago, and there, too, the state of trade is less active. One seller of shop supplies puts it that the summer has commenced about a month sooner than usual. Another says the dullness reminds him more of the way it generally goes in August. Among the dealers in shop supplies ex-

clusively the general verdict is that business is quiet. This applies without modification to the local trade at Chicago, but to some extent also to the country buying. The slackening pace of business has affected store trade but not the factories. The latter have enough orders booked, perhaps, to keep running during the dull summer months and until the fall trade sends in a fresh supply of orders. The observation, however, must be made that the comparisons in this reduced showing are with the unnaturally brisk conditions of a year ago. When the aggregate business of the past several years is considered, the totals are fully up to the normal.

There are no specific reasons urged for the diminished trade other than the effects of the strikes and of the falling prices, which are holding back quite a number of improvements. The general business conditions throughout the West are pronounced good, with a few exceptions. At St. Louis nothing is doing on account of the street railway strike. It is said that many of the larger manufacturing plants in that city are practically idle.

The repair man and the manufacturer of shop fittings tell a different story from that of the tool builder. Mechanics' tools, emery wheels and similar supplies may be neglected, but for shafting, pulleys, belting, etc., there is an active trade. One explanation of this is that manufacturers are taking advantage of the present dullness to make necessary improvements. The trade is not confined to repairs, but extends to new factories and to additions to old ones. Much of this work was contracted some time ago, but there is a steady amount of new business coming into the market.

Prices of iron and steel material are lowering without cessation, and this is the chief attributed cause of the dilatory character of trade. The degree to which consumers are trying to evade the purchase of needed supplies has not been equaled in the West in many years. This brake upon enterprise pervades all manner and condition of business, but must give way to renewed buying upon an enlarged scale as soon as confidence is restored that values have reached the minimum. The last crisis of the labor question for the year, it is thought, will be reached July 1, and with differences then pending settled the way will be clear for the beginnings of the fall trade, which it is the general opinion will attain large proportions.

PENNSYLVANIA NOTES.

Within a few weeks past a representative of the "American Machinist" has been visiting Pennsylvania shops and obtained reports as follows:

Craig Ridgway & Sons Co., Coatesville, are doing a big business in their cranes, and are installing them all over the country. They have orders enough to keep them at full pressure for some months, and are meditating increase in their plant. They are a distinctly reformative firm, applying their cranes to shops and foundries which have clung long to the hand crane.

The Champion Blower and Forge Company, Lancaster, is all a-hustle. Its facilities have been taxed to the utmost, and the amount of work being turned out is comparatively enormous. It has been particularly favored in its raw material purchases, and in the fact that it has been able to hold its prices steady when others have been constrained to fluctuate them in accord with the market.

The goods of the Lancaster Peerless Emery Wheel Company, Lancaster, are in steady demand, both wheels and the graded emery, of which they import large quantities.

The factory of the Union Drawn Steel Company, manufacturer of shafting, etc., at Beaver Falls, is very busy, and large shipments are made daily. The somewhat unsettled condition of the market has not yet made any difference either in its orders or output.

Quotations.

NEW YORK, Monday, June 18, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$19 50 @ $20 00
No. 2 X foundry	18 50 @ 19 00
No. 2 plain	17 00 @ 17 50
Alabama Irons:	
No. 1 foundry	21 00 @ 21 25
No. 2 foundry	20 00 @ 20 25
No. 3 foundry	19 00 @ 19 25
No. 1 soft	21 00 @ 21 25
No. 2 soft	20 00 @ 20 25
Foundry forge	17 75 @ 18 25

The pig-iron market is weak and extremely irregular.

Bar Iron—Base sizes—The price on dock is 1.70 @ 1.75c. for good refined brands and 2.15c. upward for same from store.

Tool Steel—Base sizes—Good standard quality, 7 @ 8c.; extra grades, 10 @ 14c.; special grades, 16c. and upward.

Machinery Steel — Base sizes — From store, 2.40 @ 2.50c.

Cold Rolled Steel Shafting—Base sizes —From store, 3½ @ 3¾c.

Copper—In carloads—Lake Superior ingot, 16⅜ @ 16½c., though it is believed some might be had at 16¼c.; electrolytic, 16⅛ @ 16⅜c.; casting, 16⅛ @ 16⅜c. The market shows a strengthening tendency.

Pig Tin—In 5 and 10-ton lots, 30.70 @ 30.75c., f. o. b.

Pig Lead—3¾c. in wholesale lots, carloads, .02½ @ .05c. extra.

Spelter—Prime Western, 4¼ @ 4⅜c., New York delivery.

Antimony — Cookson's, 10¾ @ 11c.; Hallett's, 9⅝c.; United States, 9⅜ @ 9½c.

Lard Oil—Prime City, 58c. in lots of one to five barrels.

Machinery Affairs in Berlin.

EDITORIAL CORRESPONDENCE.

For about a week past I have been here in Berlin, traveling hither by the famed Nord-Express, or *Train de Luxe*. This train makes the run in eighteen hours elapsed time. Traveling between the two principal capitals of Continental Europe, it is intended to, and undoubtedly does, represent the highest attainment in railroad service here. The distance from Paris to Berlin is 1,079 kilometers, or 670.6 miles, and the rate, therefore, is a little over 36 miles per hour, including stops. The cars do not ride as smoothly as ours do on our best roads, where special express trains are run, and for some reason not clear to me, they seem to make much longer stops at stations than our express trains usually do. The cars are known as corridor cars; *i. e.*, they have a corridor running along one side, with doors opening into compartments, or staterooms, which, in the sleepers, are fitted up as berths, with accommodations for two or four persons in each compartment, the berths being made up crosswise of the car instead of lengthwise, as in our Pullmans. They are quite comfortable, and even luxurious. The arrangement permits one to secure considerably more of the privacy which seems to be so dear to the hearts of European travelers where one person or one party takes a whole compartment; but, on the other hand, where strangers are to occupy the same compartment with you, you are forced into an intimacy of companionship not approached on American roads, and which, I imagine, might under some circumstances be exceedingly objectionable. The train is vestibuled, and a dining car with an excellent cuisine is attached. The charge is extravagant, first-class fare being higher than in America, and for sleeping accommodations rather more than twice as much. If you stop in Berlin not more than twelve days you can buy a return-trip ticket at 25 per cent. reduction, but this does not apply to the sleeping car ticket, which must be paid for at full rates both ways. Whether the American or the Continental sleeper is, on the whole, more comfortable and agreeable is, of course, a matter of taste and education. I prefer the American, perhaps because I am used to it more than for any better reason.

SALES AGENTS AND ASSIGNMENT OF TERRITORY TO THEM.

There is a fresh outbreak of the perennial difficulty between American tool builders and their European sales agents regarding the assignment of exclusive territory and the protection of the agent within that territory. The chief storm centers at present are Paris and Berlin, with "accompanying atmospheric disturbances" at Brussels and elsewhere. In Paris the American builders meet and exchange tales of woe about the agents, some of

whom demand that they shall be given exclusive territory and that the American manufacturer shall refuse to deliver any specified bill of goods to another agent whenever it appears probable that these goods are destined for points within the assigned territory. Some of our builders are quite indignant at being asked to do detective work at long range in order to find out the destination of each bill of goods ordered; or to refuse to ship simply upon the basis of a statement made by a competing agent that the goods in question are intended to go into his territory. Some of them declare that the end of it all will be that either the American manufacturer will have his own house in Europe, from which he will sell his own tools, or that he will have a certain fixed trade price, which he will quote to all dealers, regardless of territorial lines, and let the goods go where they will. There is one prominent dealer in Paris who would probably welcome this latter arrangement; but, on the other hand, most other dealers strongly oppose any move in that direction and assert that it would be ruinous to the trade here. This latter view of the situation is especially strongly held here in Berlin, and to get at the facts as they actually are and to know the views of the leading men who are engaged in the business has been one of my principal objects in coming here, because, of course, as we all know, European trade in machinery has been and still is of very great importance to American machine shops, and it is rather needful that conditions as they appear on the ground should be as generally and as thoroughly understood as possible.

In the case of Gustav Diechmann & Sohn I find that this difficulty has not manifested itself to any considerable extent. They represent here in Berlin only a few of the best American firms, including the Brown & Sharpe Manufacturing Company, and Mr. Diechmann informs me that there has never been any question or difficulty with any of the firms they represent. They all fully agree to the principle of the assignment of exclusive territory, and do what they can to prevent encroachment by other agents upon the territory so assigned. The plan has worked well with them, and both sides are well pleased with it, the business having grown enormously during the three years' interval since my former visit to Berlin, necessitating removal to much larger and better quarters and the employment of a much larger force in the office and on the road.

The firm of Schuchardt & Schütte represents a great many different manufacturers of machine and small tools. Their business extends over a very wide territory. They have many branch houses and traveling representatives, and they push their business with very great energy. It is this last named firm against whom most complaints are brought by other agents, and which, on the other hand, has had most complaints to make of encroachments upon territory assigned to itself. I have therefore been at some pains to get their views, and at two different conferences with the heads of the firm have been favored with a very full and candid statement of the principles upon which they conduct business. I cannot attempt to quote their words, but think I can make a statement that will fairly represent their views.

In the first place, it should be recalled that up to about the time of the Chicago exhibition, or a few years before, comparatively little was known in Europe of American tool builders. Brown & Sharpe and Pratt & Whitney were names that were more or less known on the Continent, but other American builders of tools were scarcely known here, and most of them not only did not dream of our doing business in this market, but had a positive belief that they never could do business here. Messrs. Schuchardt & Schütte, who originally dealt in metals and supplies, had occasionally obtained from America on order a few machine tools, and thought they foresaw the opportunity to build up a good business in such tools. The head of the firm finally visited America and, not without considerable difficulty, caused by the skepticism of American builders, succeeded in making arrangements with a number of them whereby a trial of the matter could be made. This trial resulted favorably, and in 1893 Mr. Schütte visited America and extended the firm's business connections there. Many letters are to be seen in their offices from American tool builders, expressing the greatest surprise and gratification at the way in which the business was going on; and while Messrs. Schuchardt & Schütte freely acknowledged that the success attained is due primarily to the excellencies of American tools, they contend that their efforts in inducing American builders to make the trial, and then in pushing the machines in this market have been important factors in building up the present large business here, a claim which few who know the facts will be disposed to deny.

It is not, however, claimed by these gentlemen that they are entitled to special consideration now for what they have done in the past. They do not claim to have acted upon or to have been influenced by any other than strictly business principles, and they ask of others only that they also shall be actuated in the same way. They had been pushing the business by means of personal and representative traveling; the business had extended to other countries besides Germany, and in asking that territory here or elsewhere should be assigned to them as exclusive sales agents, they have steadily recognized that they must do something more than merely to sit still and wait for customers, but must go out as missionaries to proclaim the virtues of American tools and to show to shop people where such tools could be put in to advantage. It was in pursuit of this principle that branch houses were established one after another in various cities of the Continent, and placed in charge usually of a man who had previously traveled in that territory and demonstrated the fact not only that he knew and could handle the trade there, but also that there was enough trade to be had to justify the establishment of such a branch. In every case the results have been favorable. Capital enough has been devoted to the business to permit of carrying adequate stocks (which is of very great importance here), and special pains have been taken to see to it that every inquiry and every "pointer" that seemed to promise the least chance of business was followed to the final ending, either of securing an order or of demonstrating that none could be secured.

This sort of work, as we all know, means expense. It cannot be done for nothing. Much money must be paid in salaries of good men and for their traveling expenses when engaged in preparatory or educative work, as well as when in actual pursuit of immediate orders, and there has never been the least hesitancy in laying out money in that way whenever there seemed a fair chance of ultimate returns.

Now comes the point of the whole matter in the fact, as stated by Messrs. Schuchardt & Schütte, that such work as this cannot possibly be carried on in any other way than by the assignment of territory and the utmost possible efforts of both parties to the arrangement to protect invasions of that territory. And further, that unless such aggressive work is done by someone, American trade cannot possibly be what it ought to be. That is to say, that if only passive work were done, if the agent, whoever he might be, were to simply sit and wait for Continental manufacturers to themselves see the opportunities or the need for American tools, the trade in them here would be very small indeed.

Now, supposing that considerable work has been done for the purpose of securing a given order, we will say in Belgium, or Russia or Finland, in which last two mentioned countries especially a great deal of preliminary work has been done in laying the foundation for the establishment of such business and personal relations as everyone finds to be of the utmost importance there. We will say that after much negotiation and the expenditure of considerable money and time, a trial order is given for one American machine tool of a certain kind. It proves satisfactory, and when the others sure to be wanted, are to be purchased, the customer, looking over the "American Machinist," sees that so-and-so in London, Paris and Brussels are also the agents for the American builders of the same machine. He writes them for

quotations, and the London house, let us say, receiving such an inquiry and having incurred no special expenses of any kind, expecting to receive the money with the order perhaps, and having no special reason for maintaining prices in that territory, quotes on a very small margin—a margin totally inadequate to afford scope for the aggressive work just described—and gets the order at a price, perhaps, materially lower than the first machine was bought for from the regular representative. The effect of such a transaction is greater and more far reaching than at first thought it would appear to be. Not only does the Berlin firm lose an order which normally belongs to it; but, what is a far more serious matter for all concerned, the customer loses confidence in them, perhaps thinks they have virtually robbed him in the primary transaction, and by this they are seriously handicapped in all future efforts to sell to him more machines of the same or any other kind. Business is done in Europe much more on a basis of personal friendship and confidence than is the case with us, and loss of once established confidence is therefore, of course, a more serious matter.

Three years ago, when I asked Messrs. Schuchardt & Schütte to do what they could to introduce and extend the influence of the "American Machinist" in the various countries of the Continent, they replied that they doubted whether its influence was on the whole good for them, because it made their customers too well acquainted with the various channels through which a given machine could be secured. They now see, however, that it is clearly impossible to prevent the general circulation of the "American Machinist" here among the more progressive manufacturing establishments, that its influence is good for trade in American tools *per se*, and that the only practicable way to prevent demoralization of the trade and such cutting of prices as will make aggressive work impossible is to prevent incursions by outsiders into territory assigned to them and to secure the co-operation of manufacturers in preventing such incursions. They are ready to face the competition that arises from the fact that there are here other dealers representing other American manufacturers of machines designed for the same or similar purposes, and believe that the ordinary conditions of business will prevent such competition from becoming demoralizing or ruinous; but what they claim it is vitally necessary to avoid is the competition of different sales agents or dealers offering identically the same machine. Moreover, Messrs. Schuchardt & Schütte do not make their business a secret. They are, in fact, uncommonly frank and free to show to anyone at all interested their books and records exhibiting their rates of profit, their expenses and the extent of their business here and in their various branches. They are glad also to have American manufacturers visit them and go over the territory covered by them to see what are the conditions of business, and they state unreservedly that they will give any manufacturer full information regarding the margin of profit on his machines handled by them, believing that they can in every case convince him that it is not greater than good business principles demand, nor greater than is necessary to enable the work to be carried on as it should be, with due consideration not only to their own interests, but to those of the builders of the machines as well. The doings of export houses in New York also have an influence in this matter, and it is known that some of them, and particularly a Liberty street house of great pretensions, is in the habit of securing machine tools from American builders on a pretense of selling in America, but really for export to Europe, and to countries covered by agreement between the manufacturer and his European agent, pains being taken in some cases to obliterate from the packing cases all marks that would enable those who might be interested to know the origin of the machines.

To sum up the matter, we may say that Schuchardt & Schütte believe in handling only one machine for a given purpose or of a given class; in selling such machines only in their own territory; in requiring that such territory be assigned to them exclusively, and that they be protected within it so far as possible, to the end that a rate of profit may be maintained, which, while not exorbitant, will be sufficient to enable aggressive work to be carried on here under the conditions as they actually exist, which conditions they maintain and declare their ability to demonstrate to the satisfaction of anyone who will take pains to investigate, are essentially different from those found in America. They declare that their interests and those of the firms they represent are bound together, and that whatever affects one unfavorably must affect the other also in the same way. They freely admit that they are in business to make money; that they will enter into a contract with a manufacturer only when they have reason to believe they can make money under the contract; that having once made such a contract they will live up to its terms with the utmost strictness, and they ask the other party to it to do the same. At the expiration of the contract, by limitation of time or otherwise, they will seek to do what seems best for them at that time, and may make a contract with another builder if it seems advisable, according to the American builder the like privilege of bettering himself if he can do so. There is no denying that this is business, and there is likewise no denying that while competition between different or similar machines made by different makers is legitimate, stimulating and wholesome, competition in securing a given order by different dealers offering identically the same machine is demoralizing and ruinous, and that in the end it must react upon the builder and injure his business.

The methods by which Messrs. Schuchardt & Schütte carry on their business are quite interesting in many respects, and, having been given facilities for so doing, I expect in a future, near-by issue to give some detailed account of their establishment, with photographs and drawings, that will give a good idea of its extent and arrangement.

CONFLICTING ACCOUNTS—BRIBERY—BEER DRINKING.

It is notoriously very difficult even for trained, experienced and conscientious observers to get at the real truth regarding social or industrial phenomena in a foreign country. If one depends entirely upon his own observation and experience, more time must be devoted to the work than can usually be afforded. On the other hand, if the experience of others is taken, it is apt to be from a single standpoint, and the view is, so to speak, flat, without perspective and not at all true to life. Again, if different individuals are conversed with stories apparently utterly unreconcilable with each other are the common result. When I visited Russia three years ago I heard much of bribery that was said to be going on extensively in connection with the sale of machinery to railroads, shipbuilding establishments, etc., and mentioned the matter in one of my letters to the "American Machinist." On the train coming from Paris to Berlin I unexpectedly met a Russian acquaintance, an engineer, familiar especially with the machine tool trade there. He assured me that I had been misled in that matter; that there is not nearly so much bribery going on there as represented to be. Not 10 per cent., he said, of the engineers of Russia were approachable in that respect. As I remember it, the charge was not made against Russian engineers, but generally against those who had to do with the placing of orders for machinery, among whom there are many officials who are not engineers. At any rate, I believe the man referred to is well acquainted with the trade there, and that he is himself strictly honest and reliable.

But I am hardly more than settled in Berlin before I am told (incidentally in a conversation about other matters) by a man whom I believe to be equally honest and truthful, that there is in Russia a great deal of bribery in connection with machine tool selling—far more of it than in any other country in Europe. Believing, as I do, in the honesty and truthfulness of both these men, I can reconcile their statements only upon the ground of different experiences with Russian trade in machine tools.

An American engineer here in Berlin, connected with one of the large new engineering establishments, tells me that there is far too much beer drinking among workmen here, and says that the rules and

regulations of the works recognize this evil by imposing double fines for tardiness or unexcused absence on Mondays.*

Speaking of the fact that Jews predominate here as leaders in business and the professions, he gave it as his opinion that this is largely due to the fact that Jews do not spend so large a portion of their time in beer drinking, nor lower their physical and mental condition by being always soaked with it.

On the other hand, another American engineer, connected with another large new manufacturing enterprise here, tells me of the remarkable freedom from drunkenness observable here among the workmen, and spoke particularly of a picnic given by the proprietors of several allied industrial establishments to their workmen and families, a picnic at which about 14,000 people were present. He was there from 3 to 10 P. M. with his wife, and although there was beer to be had in any quantity desired by any individual, there was absolutely no drunkenness, nor anything approaching it, and he thought the behavior of the crowd was much superior in that respect to what would have been the behavior of a similar crowd under similar circumstances at home.

Now, both these men are well known to me, and I am confident that both intend nothing else than to state exact facts as they see them. They have both been here in Berlin about an equal length of time, and are both wide-awake, smart, intelligent men, without strong prejudices either way, so far as I can discern. I leave to others the task of reconciling their statements.

SOME GERMAN-AMERICAN SHOPS.

Berlin has two tool-building establishments about which we hear very much in America, and both of which are, in fact, permeated with the same ideas that prevail in many of our leading establishments operated for the same purpose.

The Deutsche Niles Works are not yet in operation, although they are nearly ready and the foundry is making castings. They are not doing as I understood was the original intention, *i. e.*, to reproduce the American Niles tools in every particular—made, in fact, from Niles drawings, but are making their own drawings, conforming, of course, in the main to Niles designs, but making such minor changes here and there as seem desirable. Mr. Hess, who has had general supervision of the erection of the shops, is manifestly out of patience with the customs of the building trades here, and finds it impossible to push things ahead as it is customary to do at home. A Berlin bricklayer, he says, lays exactly one-third as many bricks per day as an American bricklayer does, and other operations are carried on at about proportionate rates.

Contractors putting up within their works any special structures or fittings would arrive on the ground with absolutely nothing for carrying on the work except the materials to be incorporated in the structure. All staging and appliances of every kind they expected to be provided by the works; not only that, but the character of the staging or scaffolding required by them is calculated to appall the man who is expected to provide it. Nothing but the utmost attainable strength and security would do, and if any reluctance to provide it were shown, the police regulations were cited as something to stand in awe of. Staging erected for a contractor has often cost more than the contract amounted to. Again, a man putting up a railing, let us say, will not touch a masonry wall if it becomes necessary to dig a hole in it, but a mason must be called (and waited for) to do that, and when the railing is properly inserted in the regularly provided orifice, the mason must again come to do the plastering and filling in around it. This, we know, is the rule in New York and other large American cities, but Mr. Hess says it is not due here to trades union rules, but is simply "their way of doing"—the custom of the trades.

Again, I hear on all sides the story that German methods do not produce good draftsmen as a rule. First-class draftsmen are, it is declared, exceedingly difficult to get hold of. Many men can be had that can make intricate mathematical calculations and can handle drawing instruments, but that is all. For everything else, I am told, most of them have to be very closely looked after. As a typical instance of what they will do, a case was related to me of a man who had to put gearing into a machine tool for the purpose of raising the speed of a shaft in the ratio of 1 to 5. He did it by making one gear wheel with sixty teeth and a pinion driven by it with twelve teeth. The figures showed him that by this arrangement he secured the proper ratio, and the books told him that a twelve-tooth pinion was permissible, and he had no practical experience or intuitive knowledge to make him understand that such an arrangement was absurd.

A somewhat similar condition seems to pervade German industrial establishments to a greater or less extent. A lot of American heavy tools went into one of them some time ago, and soon after they were delivered there were complaints that they would not do the work they had been sold to do. A lathe, for instance, they declared could not make a certain cut on a certain connecting rod, and so on, all through the list. An American engineer, remotely, though not directly, connected with the American builders of the tools, was finally asked to come in, and although not obligated to do so, consented. There was a conference at the works between the bankers who were backing the enterprise and the "technical directors," foremen, etc. The American listened to the various statements and saw the assumed demonstrations that the tools would not do the work, and said nothing until he was asked why he had nothing to say and requested to speak out. He then said there was only one thing to be said, and that was that the leading men of the place understood next to nothing of their business. Now, said he to the financial men, who, of course, did not pretend to understand the technicalities of the matter, "you have heard all your leading men declare that these tools, the lathe, the boring and turning mill, the planer, etc., will not do such and such jobs of work. If you will permit me to do so, I will demonstrate that they will do all these jobs, and do them well." He did so, handling the tools himself and doing the work as it is regularly done at home. Not only were there some astonished men at the fact that the tools would do the work, but much more at the fact that one who was not a mere workmen, but "over engineer" of a large works, should be able to do it with his own hands. In their experience such a thing was unprecedented, and they could not understand it, nor scarcely credit the evidence of their own senses.

Such a thing is not absolutely unknown here, however, as is shown by the fact that the director of the shops of Ludw. Loewe & Co., Julius F. Pajeken, worked in his younger days as a machinist and served his apprenticeship at the Morgan Iron Works.

In only a very few workshops anywhere in the world, so far as my observation goes, do we find such advanced ideas of shop management as are to be found in this establishment. Messrs. Loewe, Pajeken, Orcutt, and others prominently identified with this business, have a thorough appreciation of the fact that a pyramid stands most securely upon its base, and that the hight to which a pyramid can be carried depends primarily upon the breadth, soundness and solidity of the base. In other words, they know that good mechanical work, economically done, means good men working under good conditions, such as will give to each the incentive to do his best and something to look forward to. They are guided by this fundamental principle. They take pride in their workshops and inspire a like pride in their workmen. Not only do they find that this is best for them, but a further significant fact is that their men are in demand, and, it is said, can always secure good places in other establishments. This, of course, means that the influence of the shop will extend far beyond its own walls, and it may do much to place the entire craft of machine construction in Germany upon a higher plane, which, of course, means greater efficiency, higher wages and better conditions generally.

There is, quite naturally, considerable speculation as to the probable effect of this establishment upon the future Amer-

*All fines imposed upon workmen by employers are required by German law to be devoted in some way to the general benefit of the workmen, collectively.

ican machine tool trade in Germany, and in fact Europe. It goes without saying that no American tools could have been sold here if there had not been more or less appreciation of the methods by which these tools are produced, and by which also the best results are to be obtained in using them. Such appreciation must of necessity develop along with the tool trade, and this could mean nothing else than the adoption by the more progressive German manufacturers of the same general practice and the development of competition based upon that practice. It would be exceedingly queer if such a result did not follow. There are those who say that the Loewe shops have too much money invested in them in proportion to their productive capacity, and while it is undoubtedly true that the ratio between cost of buildings and cost of equipment is high, it must be remembered that German conditions and requirements do not permit of so low a ratio as is possible in America; and then there is the further fact that the best possible shop buildings make the better showing on the balance sheet after a term of years. That is to say, if wisely planned, they are still good and efficient for their purpose without material expense for repairs or alterations after cheaper buildings are superannuated. Besides all this, and more important so far as its effect upon competitive conditions are concerned, manufacturers do not and cannot add to the cost of machines sold in competitive markets heavy fixed charges due to abnormally high cost shop buildings, any more than they do or can add to selling prices of such machines an extra amount to cover inordinate cost caused by poor buildings and equipment. If shop buildings cost more than they should the effect manifests itself in the price of the shares of stock of the company owning the building, not in the prices charged for the product sold in open competition with similar products of other shops.

I have made some study of the Loewe shops, and find in them very many of the ideas and practices that, according to an article of faith held by all advanced American shop men, are correct and must give good results in quality and cost of work. I do not mean that it is in all respects an American shop, but it is in many ways very like the best of our shops, and there is some difference in the rate of wages paid to compensate for differences in the men, though I believe the difference in wages and men employed in doing what the English aptly call repetition work is not so great as many imagine it to be.

I have been afforded facilities for giving a more detailed account of some of the features of these remarkable shops, and intend doing so in a future issue.

THE GENERAL BUSINESS SITUATION.

As to the general business situation here in Germany, it may fairly be said that, although there has been, as most of us have known, a considerable falling off, the condition is by no means bad, and the rolling mills, iron and steel works and shipbuilding establishments are busy. But during the past ten years Germany's mechanical industries have been very rapidly extending. German banks have been rendering valuable assistance in this work by their policy of supplying manufacturing enterprises with all the funds needed at low rates of interest, a policy which they were enabled to carry out partly with the assistance of British and French capital, which has flowed into Germany in considerable amounts. Recently, however, on account of the South African war, British capital has not only not been coming into Germany, but has been withdrawn in considerable amounts, and there has been also not so much French capital coming in, because French bankers have had opportunities of investing in what they think will give higher rates of profit. This has made the German bankers not only reluctant to supply funds for new enterprises, but has made them draw in as much as possible to strengthen their reserves, and many industrial enterprises, especially those which have been recently established, have not yet had time to get into full swing, and have at the same time considerable amounts of outstanding liabilities, are by this condition rather seriously impeded. This is substantially the view of a man who is a large manufacturer and capitalist here, and who thinks also that the anticipation of a possible large flow of American iron and steel and coal into Germany has a tendency to make manufacturers and capitalists play more or less the waiting game. It is believed that matters will improve, and, in fact, that they will not grow really bad, though there may not be in the future such a boom as has been witnessed for a few years past.

Berlin, May 28. F. J. M.

The Properties and Uses of Logarithmic Cross Section Paper.

BY J. A. BROWN.

The columns of the "American Machinist" have contained much interesting matter on the subject of diagrams, but very little mention has been made of logarithmic cross-section paper for this purpose. In many cases formulas plotted on this paper form diagrams that are easily constructed, accurate, and of wide range. This is especially true of those formulas consisting of a constant and the root or power of another quantity. The first cost of this paper is perhaps the greatest bar to its free use, especially so to the individual draftsman, whose "blue book" is constructed at his own expense. Since, however, Mr. Bruce and Mr. Lewis have placed in the hands of every reader of the "American Machinist" logarithmic scales of different lengths, a sheet can readily be traced from the printed page sufficiently accurate for most purposes.

The use of this paper is so closely related to that of the slide rule, both in principle and operation, that much that can be and has been said in favor of the slide rule applies equally well to this paper. In fact, when the manipulation of this paper is understood, any good book on the slide rule will illustrate formulas that may with advantage be laid out on this paper. Most questions requiring "gage points" or constants can be put in the form of diagrams at once. Every user of the slide rule knows the constant temptation to scratch various marks of this kind on his rule. Having worked out some more or less intricate setting after a struggle, it costs a regret when we lose it. Now these various settings can be recorded on this paper in permanent form for future use. It also offers a rich field for those who delight in that class of problems, called by Mr. Halsey "slide-rule gymnastics"—problems which, by the way, have done much to discourage a free and proper use of the slide rule.

As the scale used in constructing this paper is logarithmic, or one on which the distance of any number from the commencement of the scale corresponds to the mantissa of its logarithm, it may be thought that a knowledge of logarithms is essential to its use. This is not so, however, and in what follows the subject of logarithms will not be discussed. The numbers and divisions are read in the same way as on any other decimal scale.

It may be of interest to compare common and logarithmic diagrams and to follow out the manner in which the results are obtained.

If we take a sheet of ordinary cross-section paper and from, say, the lower left-hand corner number equal divisions on the horizontal and vertical scales, and from these points draw a series of parallel diagonals, we will have constructed an addition and subtraction diagram. Tracing a horizontal line from any number on the vertical scale until it intercepts the diagonal drawn from any number on the horizontal scale, we find the sum below on the horizontal scale. For example, in Fig. 1 the sum of 3 and 2 is found by following the horizontal from 3 until we intercept the diagonal from 2 on the horizontal scale. Reading on the horizontal scale the sum will be found to be 5. If we take the diagonal on the left of the center diagonal, reading its value on the vertical scale, we subtract its value. For example: $3 - 2 = 1$, or $9 - 3 = 6$, etc.

(This principle was illustrated by Henry Hess in issue of August 12, 1897, and by H. M. Norris in issue of June 23, 1898.)

The operations of multiplication and division by means of similar triangles are shown in Fig. 2. For example, if we divide the upper horizontal line by 2, 3 or 4 and draw lines to the lower left-hand corner, we divide all numbers on the vertical scale in the same proportion. For example: $8 \div 2 = 4$. $8 \div 4 = 2$. By

making the length of the horizontal scale any number of times that of the vertical scale, we multiply all numbers on the vertical scale by that number. For example: $3 \times 2 = 6$. These operations have been fully illustrated from time to time in the diagrams appearing in the "American Machinist."

These same constructions when applied to logarithmic cross-section paper give other results. The parallel diagonals give multiplication and division instead of addition and subtraction, and the radiating lines corresponding to those shown in Fig. 2 give roots and powers.

One or two illustrations will make these relations clear. Take a sheet of logarithmic cross-section paper and place it so that the scales read from the bottom up and from left to right, Fig. 3. A diagonal drawn from the lower left hand, or 1—1, corner to the upper right hand, or 10—10, corner will be found to intercept equal values on both horizontal and vertical scales, and has a value of unity, or 1. It should be noted that the figures as marked are arbitrary and may be multiplied or divided by any multiple of 10. In multiplication read the multiplicand on the vertical scale at the left and the multiplier on the horizontal scales. If the product is found under the intersection with the diagonal leading from the bottom scale, the number of places will be one less than the sum of those of the multiplier and the multiplicand. If the product is found under the intersection with the diagonal leading from the top scale, the number of places will be equal to the sum of those of the multiplier and the multiplicand. For example, in Fig. 3 draw diagonals from 2 on both lower and upper horizontal scales. Then the product of 3×2 will be 6, and the number of places $(1 + 1) - 1$, or 1. $30 \times 2 = 60$; number of places $(2 + 1) - 1 = 2$. On the upper diagonal, $7 \times 2 = 14$, and the number of places is $1 + 1 = 2$. $70 \times 20 = 1{,}400$, and the number of places is $2 + 2 = 4$.

In division the diagonals lead from the vertical scales. If the result is found from the intersection with the diagonal on the left-hand scale, the number of places is equal to those of the dividend plus one, less those of the divisor. Example: $\frac{3}{2} = 1.5$; number of places, $(1 + 1) - 1 = 1$. $\frac{30}{2} = 15$; number of places, $(2 + 1) - 1 = 2$. If the result is found from using the right-hand diagonal, the number of places is equal to those of the dividend less those of the divisor. For example: $\frac{1.5}{2} = .75$; number of places, $(1 - 1) = 0$. $\frac{150}{2} = 75$; number of places, $(3 - 1) = 2$. It will be seen that the product of the values at the ends of any diagonal is always equal to 10 or 1, the result being the same when dividing by 5 as when multiplying by .2. In other words, the values at opposite ends of a diagonal are reciprocal to each other.

Reciprocals may be read directly by drawing a diagonal from the left-hand 1—10 corner to the right-hand 1—10 corner, as in Fig. 4. From any number on the vertical scale trace a horizontal intercepting this diagonal, and the reciprocal will be found on the horizontal scale under the intersection; that is, numbers read on the vertical and the horizontal scales are factors whose product is 1 or 10.

From any value in the lower horizontal scale draw a diagonal parallel to the middle diagonal, and continue this to the top of the sheet by entering the right-hand side with the same value that it leaves the left-hand side. All intersections with this diagonal give a series of pairs of factors whose product is the same and equal to the number at the starting point of the diagonal. In the same way this diagonal may be drawn from the intersection of any pair of known factors. It will be seen that this is a case of inverse proportion, and solves many questions relating to speeds and diameters of pulleys, diameters and teeth of gears, pressure and volume of gases at constant temperature, etc.

Example: The product of two numbers equals the constant 39.8. Draw the diagonal *A B*, Fig. 4, from 398 on the lower scale and continue it on the right (*C D*). Let one of the numbers be 521, then the other will be found to be .0764.

Again, let two numbers be 72 and 2; then by drawing a diagonal through their intersection their product is seen to be 144, and a number of other pairs of factors having this product can be found, 3×48, 4×36, 6×24, etc.

If the upper horizontal scale be divided by 2, 3 or 4 and lines be drawn from these points to the lower left-hand corner, we have the square, cube and fourth roots, respectively, of all numbers of one figure up to 10. Lines parallel to these will complete the table. It will be seen that it requires two full lines to complete a table of square roots or squares, three lines for cube roots, four for fourth roots, etc. If we use the horizontal scale for roots of the numbers read on the vertical scale, we can use the vertical scale for powers of numbers on the horizontal scale. It is better perhaps to use the vertical scale only for original numbers, reading by means of two sets of lines both roots and

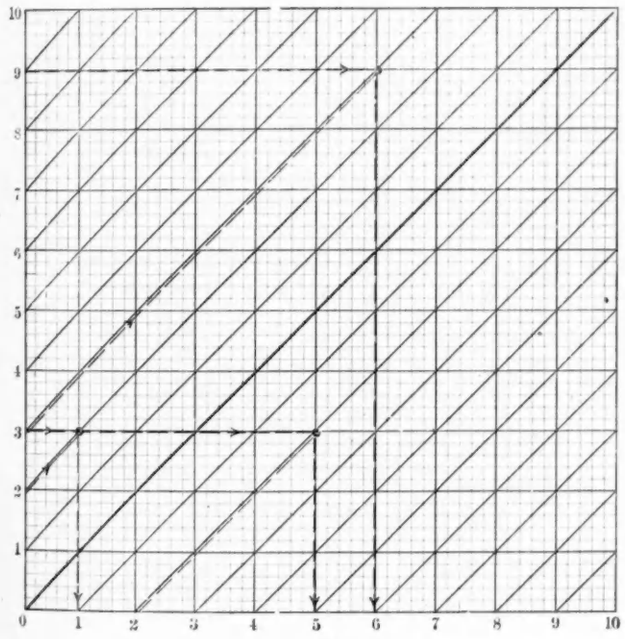


Fig. 1

ADDITION AND SUBTRACTION BY CROSS-SECTION PAPER.

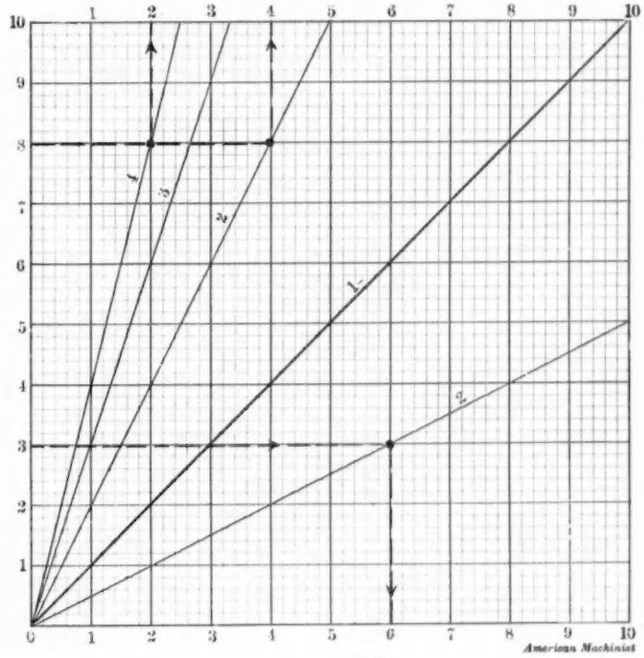


Fig. 2

MULTIPLICATION AND DIVISION BY CROSS-SECTION PAPER.

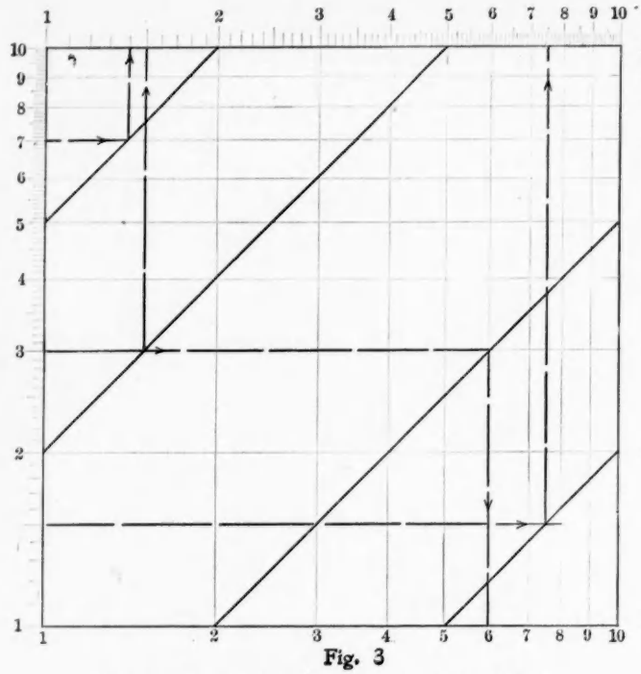


Fig. 3

MULTIPLICATION AND DIVISION BY LOGARITHMIC CROSS-SECTION PAPER.

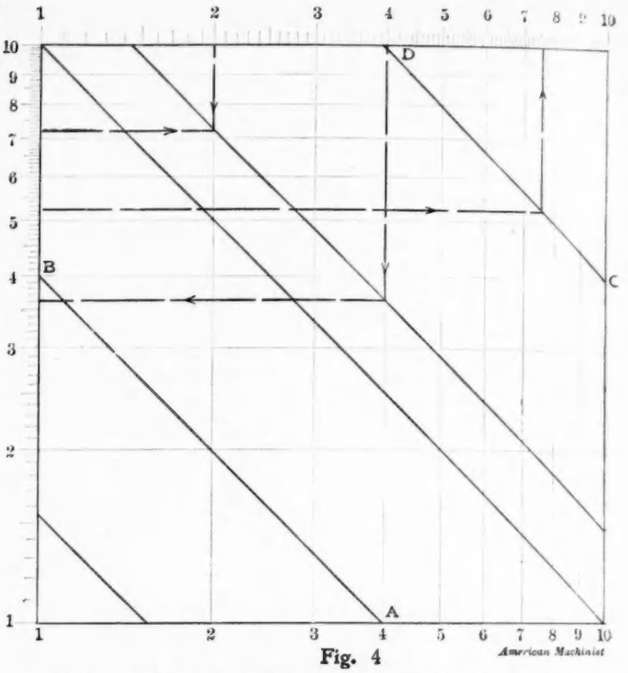


Fig. 4

RECIPROCALS AND INVERSE PROPORTION BY LOGARITHMIC CROSS-SECTION PAPER.

powers on the horizontal scale. For example, Fig. 5, taking the diagram of squares, we find the square of 5 to be 25, the square root of 5 to be 2.24, the square root of 50 to be 7.07. In the same way we find the cube of 5 to be 125. And the cube roots of 5, 50 and 500 are read off as 1.71, 3.68 and 7.94.

In the diagram for square roots the actual length of the upper scale was divided by 2, which is the same as multiplying it by .5. For cube roots we divided it by 3 or multiplied by .33, so in the same way we can find the value of numbers raised to any fractional power. To raise numbers to the .29 power we multiply the actual length of the horizontal scale by .29 and by setting off this distance from the left-hand end and drawing a line from this point to the lower left-hand corner we can read from the vertical scale the .29th power of all numbers from 1 to 10.

(To be continued, with an article showing the application of these principles to the construction of a diagram for solving compressed-air problems.)

The first section of the largest oil-pipe line in the world has just been completed in Russia. The entire line is to be 560 miles long, running parallel to the track of the Trans-Caucasian Railway. The section completed is 145 miles long. The pipe is 8 inches diameter, wrought iron, lap welded. There are three pumping stations, and in each are two of the largest Worthington pumping engines ever employed in such work. This makes six compound high-duty engines with cylinders 21 and 42 inches, plungers 8½ inches and 24-inch stroke.

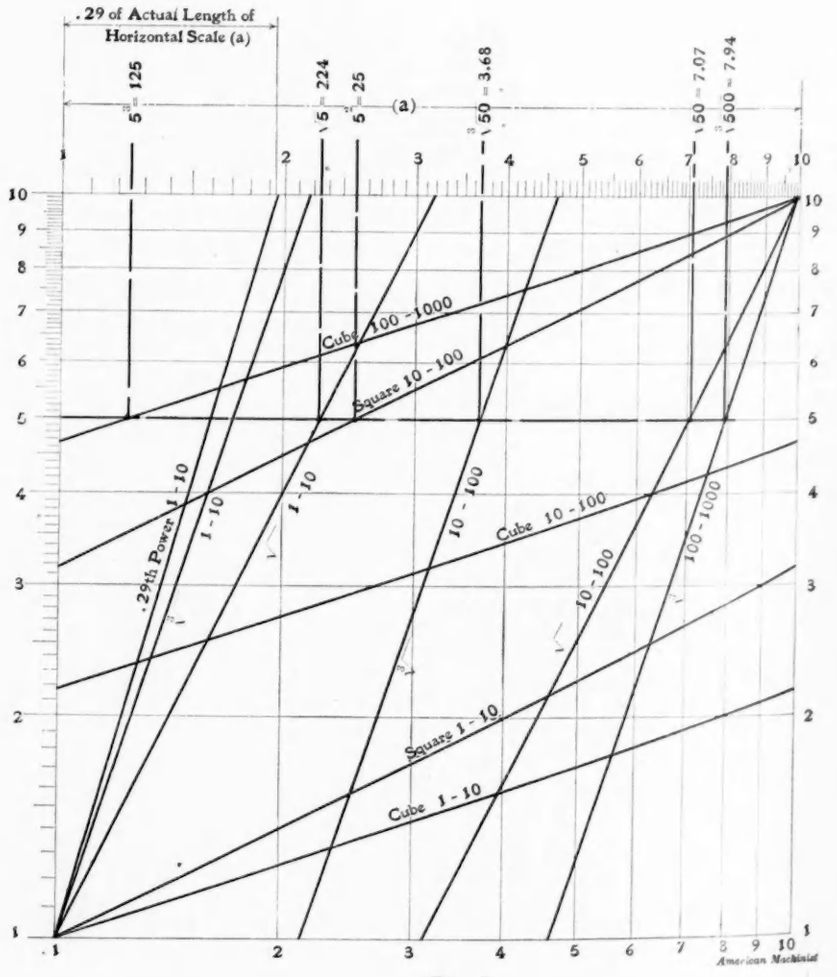

.29 of Actual Length of Horizontal Scale (a)
(a)
Cube 100 - 1000
Square 10 - 100
Cube 10 - 100
Square 1 - 10
Cube 1 - 10
.29th Power 1 - 10
American Machinist

Fig. 5

POWERS AND ROOTS BY LOGARITHMIC CROSS-SECTION PAPER.

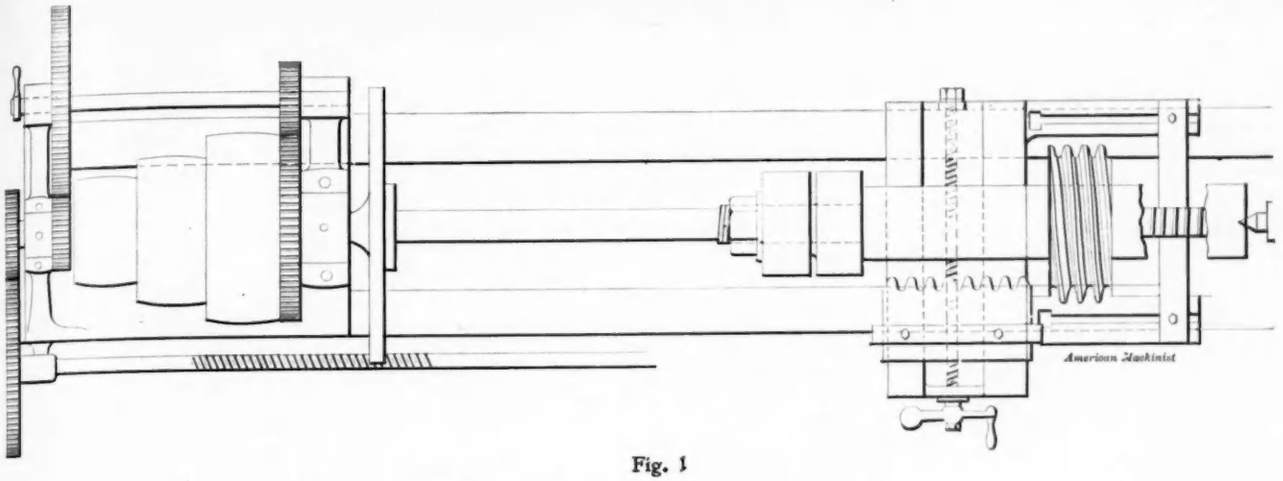


Fig. 1

CUTTING SPIRAL GEARS IN THE LATHE.

Cutting Spiral Gears on the Lathe.

BY GEO. R. MARTIN.

Having some gas engine worms and worm wheels to cut, the wheels were cut on a milling machine, but as the table would not swing around to the angle required for cutting the worm, I had to cast around for another means of doing them, with the result that they were done on a lathe far cheaper than they could have been done on a milling machine.

They were required to have nine teeth, 3¾ inches in diameter on pitch circle; .584 inch normal pitch; angle with axis, 63° 26′ 7″; pitch of spiral, 5⅞ inches.

An enlarged, or pattern, gear was first procured of the desired pitch and keyed to the mandrel (of tool steel), which also carried the blanks to be cut. Engaging with this pattern wheel and bolted down to the saddle was a rack which served to traverse the saddle. The other end of the mandrel was turned down to suit the hole in the blanks to be cut (which were cut two at a time), and a feather way was put in to prevent the blanks turning. A thread and nut were also provided to keep them in position against the shoulder, as shown in Fig. 1.

A piece of flat tool steel was now taken, about 1 inch thick and wide enough to cut nine teeth, and was mounted on an angle plate on the milling machine at such an angle, or rather combination of angles, as would give a cutting angle or clearance and the angle due to pitch of spiral. (See Figs. 2, 3, 4 and 5.) Of course, as it had a proper clearance it was only necessary to grind it on the face to sharpen it. This was then hardened and tempered and bolted to the rest, as shown in Fig. 1, when all was ready for starting.

I ought to mention that the overhead countershaft was reversing, and that the cross slide had a screw-cutting stop or gage to adjust the cut.

The tool was now adjusted to take a cut of about .01 inch, and the lathe started forward, when the saddle, propelled by the rack and pattern wheel, commenced traveling towards the face plate, one tooth following the other in engaging with the blanks until all had passed right along and got into the clearance space between the blanks and face plate. The rest was then moved back to clear the blanks, and the lathe was reversed until it had traveled back to the position shown, when it was ready for the next cut, and these operations were continued until the teeth were cut the full depth required.

The actual time of cutting taken over the first pair of wheels made was 45 minutes, or 22½ minutes apiece. This time has since been considerably reduced, as it was thought worth while building a special machine for the purpose.

I should have mentioned that it was found necessary to add a strap to hold pattern wheel and rack in close engagement, as otherwise they forced slightly apart. This is not shown in the sketch, but would be obvious.

Shipley, Yorkshire, England.

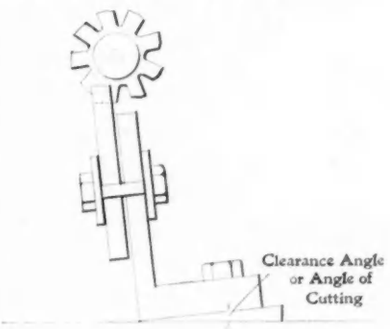


Fig. 2

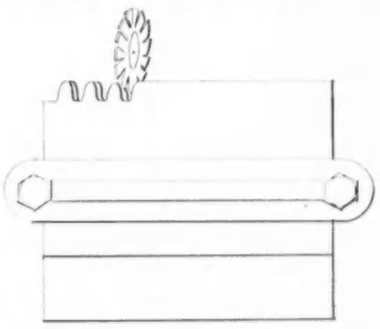


Fig. 3

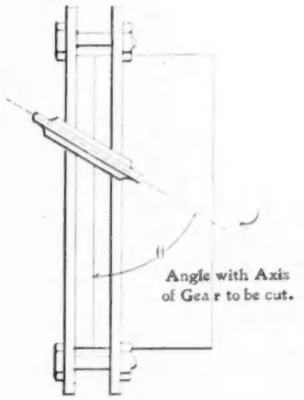


Fig. 4

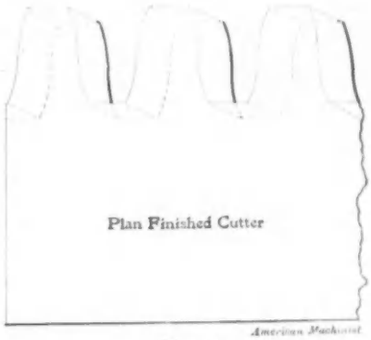


Fig. 5

PLAN OF CUTTER AND METHOD OF MAKING IT.

Legal Notes—Failure to Warn Inexperienced Boy—Failure to Warn in Use of Linter.

BY WM. MARSTON SEABURY.

Not long ago the Court of Civil Appeals of Texas rendered its decision in the case of Henry Wallace against the Southern Cotton-Oil Company. The plaintiff, who

was a boy of seventeen years of age, was in the employ of the defendant, and while so employed and while acting in the discharge of his duty, undertook to press a bale of hulls in the company's hull press. While so engaged his hand was caught in the press and mashed off, leaving only the thumb.

To recover damages for this injury the plaintiff brought suit. He maintained that the press was a dangerous piece of machinery, with the uses and dangers of which he was not familiar. That he had been operating the press only about two hours before the accident occurred. He further contended that he was unaccustomed to the use of machinery, and that the defendant knew of his inexperience, youth and lack of knowledge, and that in spite of this the defendant had failed to warn him of the danger incident to the management of the press, and had failed to instruct him how to use it with safety. He also complained that the defendant was negligent in failing to properly light the building where the work was done.

The defendant, in answer to these contentions on the part of the plaintiff, denied these allegations, and declared that the accident occurred through the carelessness of the plaintiff.

The jury in the trial court brought in a verdict of $1,800 in favor of the plaintiff, and upon the verdict a judgment was entered, and the defendant appealed.

In affirming the judgment the Appellate Court said: "Whether the injury was due to negligence on the part of the appellee (the plaintiff) or was the result of a risk assumed by him are questions upon which, in the light of the evidence, the verdict and judgment are conclusive." (54 S. W. R., 638.)

FAILURE TO WARN IN USE OF LINTER.

Another action involving a somewhat similar question to the case of Wallace against the Southern Cotton-Oil Company is that of Charles E. White against the Hillsboro Oil Company, decided by the Texas Court of Civil Appeals a short time prior to the case referred to. It appeared that White was injured while using a linter, which is a machine used by cotton-oil companies for cleaning seed. Plaintiff alleged that he was not familiar with the work of cleaning away the rubbish from under the linter, and that although this fact was known to the defendant's foreman, this foreman had ordered plaintiff to do the work, without warning him of the danger, and that owing to the defectiveness of the machine, caused by an extraordinary accumulation of refuse under the linter, it was rendered very dangerous and unsafe. The plaintiff also alleged that he was not furnished with a proper tool with which to remove the rubbish.

The defendant's answer to these allegations was that the plaintiff had represented himself when employed as an experienced machinist and that he thoroughly understood the work, and that he therefore assumed all the risks incident thereto; that plaintiff had refused to use the stick furnished for the purpose of removing the accumulated rubbish, and that he had attempted to remove the rubbish with his hands while the machine was in motion, which was contrary to his instructions, and that he was guilty of contributory negligence.

Judgment was rendered in favor of the plaintiff in the lower court, and upon appeal it was affirmed, the Appellate Court refusing to disturb it, and finding that it was justified upon all the evidence in the case. (54 S. W. R., 432.)

A Draw-Cut, Traveling-Head Shaper with Rotary Planing Attachment.

The accompanying half-tone shows a machine of new design, with a sample of the work that it does. The machine is essentially of the shaper class, having a draw cut, instead of the, perhaps, more familiar thrust, and, having also a rotary head attachable to the end of the ram for facing operations, it may claim kinship to the milling machine. The foundation or floor plate of this machine is almost entirely concealed in the view here given by the engine bed which stands upon it. This floor plate is 10 feet 6 inches long, 9 feet wide and 12 inches thick, ribbed and cross-ribbed, and made in three sections, which are so constructed that any additional sections may be attached as required. The plate has 12 T-slots in its face for bolting work to it. The bed proper of the machine is seen at the right. This is bolted to the floor plate and at right angles to it. To this bed is secured the stiff vertical column of the machine. The plate on the front of this column is for the purpose of bolting in a bearing between the column and any high work to be operated on, the strain of the draw cut being thus taken directly against the column.

The shaper apron or saddle is gibbed to the upright column with long and ample bearing surfaces. The raising, lowering and vertical feeding is done by a stationary feed screw and revolving nut, with bevel gear connections. This table carries all the feed and other actuating mechanisms required in the operation of the machine. The longitudinal feed is obtained by a spline shaft in the vertical column, connected with mitre gears in the saddle and with bevel gears and revolving nut at its lower extremity, and thence by a stationary screw passing the entire length of the bed and rigidly fastened. Either feed may be worked by hand by applying a crank to the squared ends of the shafts.

The shaper ram is driven by a worm and gear, the worm being submerged in oil and thoroughly lubricated. The ram is made of steel cast hollow and square, with rack teeth cut from the solid on the back side. It is bored at its extremities, and provisions made to receive a steel arbor running its entire length. The pinion or main driving gear is also of steel. The feed for the shaper is obtained from an automatically relieving friction drive. The power is conveyed thereto through a bevel gear secured to the upper end of the main driving shaft, and thence by a pinion the power is transmitted to a horizontal feed shaft, to which the friction is applied. The usual means are employed for adjusting the feed. The power from said friction is conveyed through a rocking arm and segment to gears and rack which transfer the same to the ratchet and shaft, giving a reciprocatory motion to said shaft as the ram of the shaper travels in its respective operations. An ordinary pawl thrown in connects the ratchet feed to either the vertical or lateral feeds by means of a sliding pinion engaging the pawl wheel and changeable to either feed as may be desired.

The stroke of the machine is adjusted by means of tappets on a circular disk. The power is furnished thereto through spiral gears. It is also supplied with a reverse lever so that the machine may be reversed by hand at any part of its stroke. The reciprocatory motion of the ram is obtained by the use of one open and one cross belt working in connection with friction clutches, the ratios being such between the pulleys on the countershaft as will give a quick return of three to one. The clutches are positively self-relieving, and are easy of adjustment, and the high-speed clutch is perfectly balanced in every way.

The countershaft is placed on a suitable hanger attached to the machine, and power is applied by an endless belt running vertically from the electric motor up to the upper idler, thence to the lower idler, passing over the driving pulley on the countershaft and thence to the motor. By this arrangement the belt is not lengthened or shortened materially when the machine is feeding vertically. The upper idler is provided with an equalizer and means of adjustment for taking up the stretch of the belt, and also with a friction clutch by which the machine may be stopped and started at any part of the stroke, independently of the motor. The machine, where preferred, may, of course, be arranged to be driven with a belt from the line shaft.

The rotary planing attachment consists of an arbor passing lengthwise through the ram, the front end being so constructed as to receive the rotary cutting head (shown with the end of the ram up at the left of the half-tone), and the rear end being connected with a train of gearing, a suitable bracket being provided for carrying the same, and the power is taken from the countershaft through bevel gears to a shaft running parallel with the arbor.

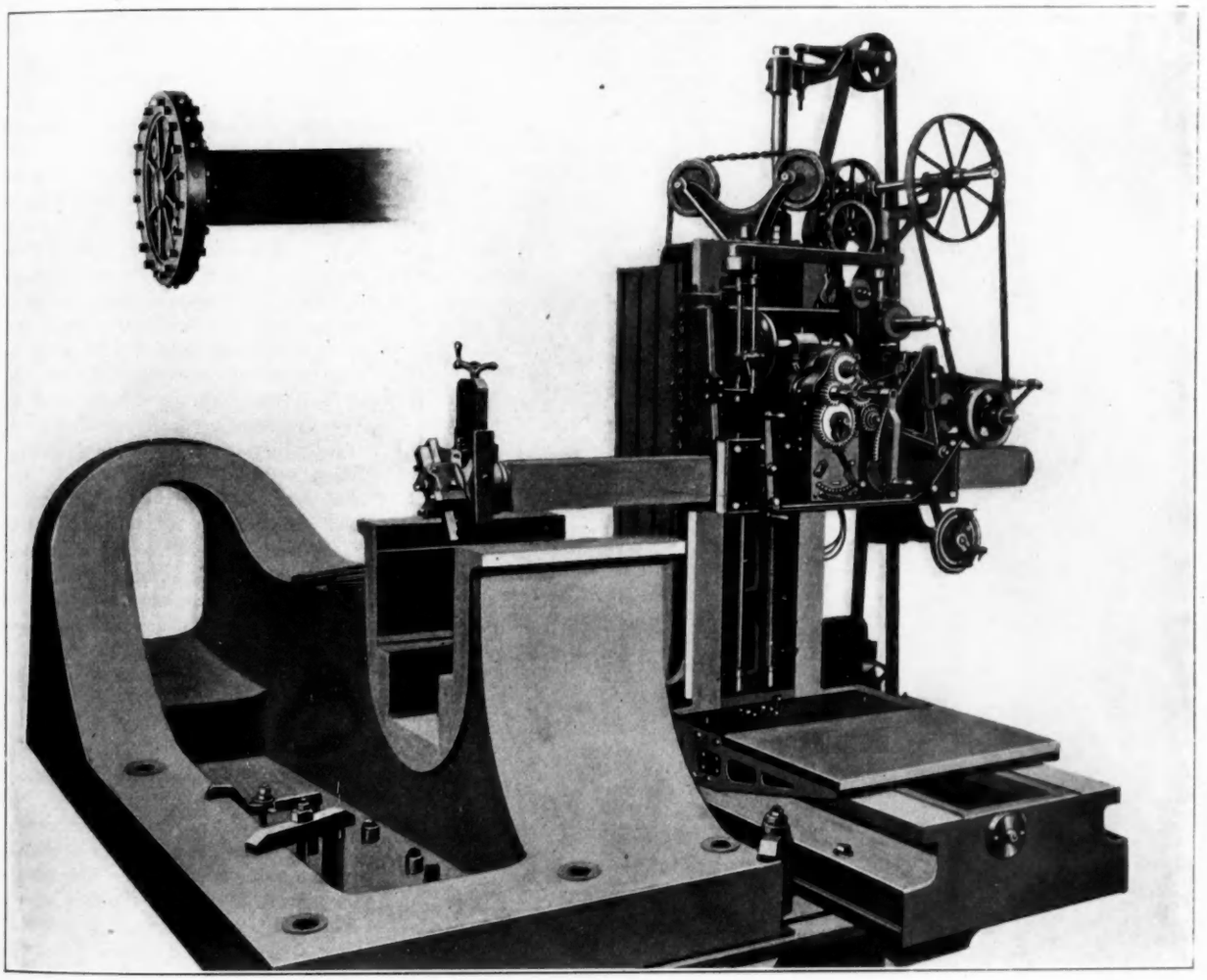
The journals, etc., supporting these

gears and shafts are encased. The parallel shaft is splined so that the driving pinion may be brought into service in any position the ram may be placed in. The ratio of the gearing is about 15 to 1. All parts of this attachment are so constructed that they are easily removed when their services are not required, and they are not shown in the view here given.

The continuous feed to be used in connection with the rotary planing attachment is taken directly from the lower driving pulley belted to a horizontal shaft, and thence to mitre gears to vertical shaft. This vertical shaft is supplied with a cone and two changes of speed, and the driven vertical shaft at the left side of the machine is provided with a friction pulley. This friction is made movable on the vertical shaft and is held in position by a simple gripping mechanism, and by this means power is applied to a friction disk secured to a horizontal shaft running parallel with the ram. The farther from the center this friction engages the disk the slower the feed will operate; while the nearer to its center, the quicker. The feed is reversed by moving the friction wheel to the opposite side of the disk. To this horizontal disk and shaft is connected a worm gear wheel running in connection with a worm gear, and by this means, through a shaft running at right angles, the power is carried to a gear provided with a friction movement for engaging and disengaging the feed. These gears are all of such diameter and so located that they can be only used for the continuous feed, thereby making it impossible to lock the feeds in any way, thus avoiding danger from breakage. This continuous feed can also be used to advantage for rapidly moving the machine up and down or sideways.

The revolving feed nuts for both lateral and vertical feeds are provided with ball bearing thrust collars. The journals are all long and large, and provision is made for taking up wear on the ram by employing taper gibs.

The tool head used on this machine is of the standard type used on the heavy Morton draw cut shaper, and the tool box is provided with an adjusting screw, whereby the tool may be fed downward or forced into the cut independent of any other feed. Special heads may be applied for various classes of work. The gearing is practically all encased and free from dirt, and the machine can be successfully used either as a draw cut, portable or a stationary traveling head shaper. It has a vertical feed on the column of 4 feet, a horizontal feed of 6 feet and a stroke of 50 inches. While this machine is designed for heavy work, it can also be used for a lighter class of work by making the table of suitable dimensions. When used as a portable machine it is used in connection with an ordinary floor plate, such as is used for erecting by many of the large shops. To adapt it for this class of work a suitable eye-bolt is placed in the upper end of the column for handling with a traveling crane. This machine is built by the Morton Manufacturing Company, Muskegon Heights, Mich.



A DRAW-CUT TRAVELING-HEAD SHAPER AND MILLER.

A pattern maker living in Brooklyn made arrangements to light his house with acetylene gas. He was all ready a few days ago, and before lighting the first burner he struck a match and passed it along the pipe and around the tank to see that all was tight. He found a leak, and he died a few hours after, without regaining consciousness.

A Large Toggle-Joint Press With Novel Features.

The half-tone, Fig. 1, shows a new toggle-joint coining press recently built for a customer in England by the Ferracute Machine Company, Bridgeton, N. J., from the designs of Mr. Oberlin Smith. Fig. 2 is a right-hand vertical section in a fore-and-aft central plane, and Fig. 3 is a fore-and-aft vertical section through the axis of the left column.

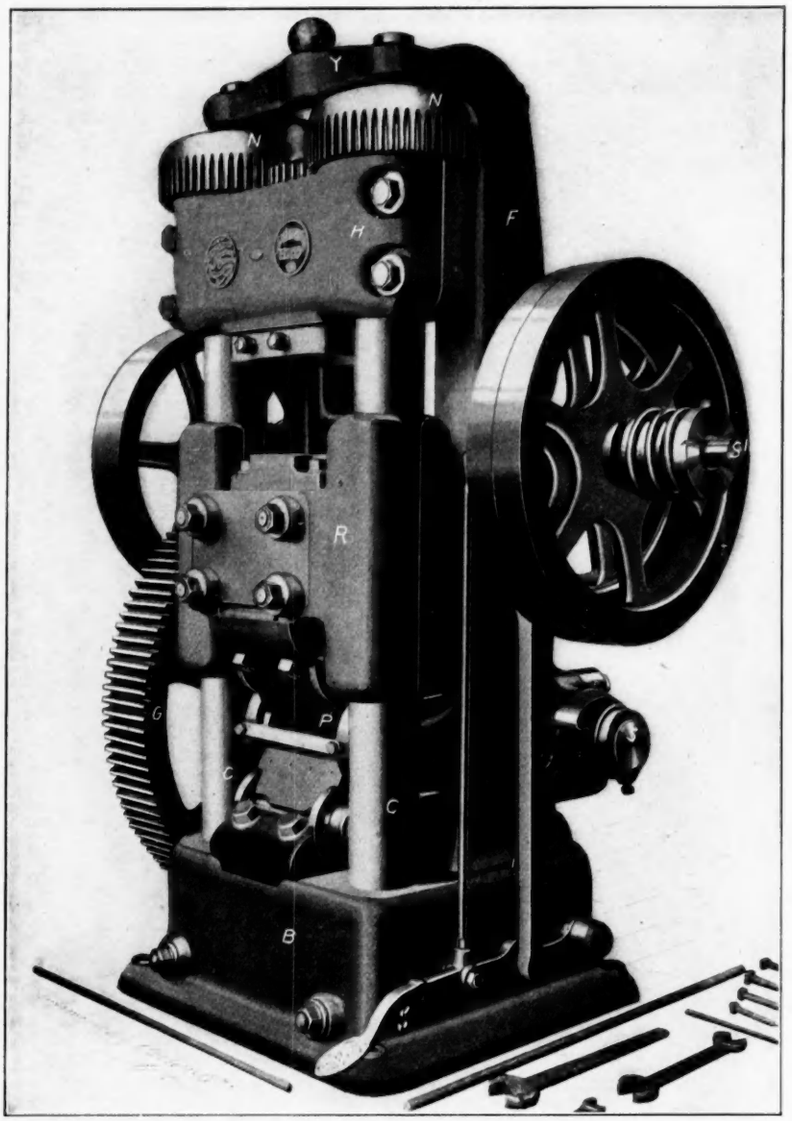


FIG. 1. A LARGE TOGGLE-JOINT PRESS.

This press weighs about 23,500 pounds, and is capable of giving a pressure of 650 tons at the finish of the ram stroke. The machine recently built is intended for cold forming and coining various parts of bicycle fittings, but it is evident that a press of this kind can be adapted to a great variety of work. The usual ram stroke is 2 inches, but this can be made more or less to order. The frame of the machine is made up of a base *B* connected by two forged steel columns *C C* for taking the tensile stresses, with a head *H* attached to the same at the top, and an auxiliary framework at the rear consisting of two frame pieces *F F*, bolted to the base and to the forged columns and connected at the top by a yoke *Y*. The base is about 4 feet square and the columns are inserted from beneath, doing their pulling upon a solid forged head, as shown in Fig. 3, and being forced upward into firm contact by wedges *W W*, which consist of cylindrical rods inserted in holes bored at a slight angle with the horizontal, and having a flatted side cut at the proper angle and resting against the bottom of the column. These wedges are inserted from the rear and conveniently operated to keep the columns tight by nuts in front. This construction is new, and prevents an unpleasant creeping up and down of the columns in the base. This is quite noticeable in many machines subject to heavy pressure which do not have the columns forced into contact so firmly as to take up at least a part of the elastic yield of the respective pieces of metal. The adjustment of the head *H* (through a distance of 6 inches) is performed by two heavy nuts *N N*, having gear teeth cut in their periphery and being operated in common by a pinion between them. After adjusting to the proper hight, the four pinch-bolts at the ends of the head are tightened to pinch the same upon the columns. To secure the same vertical firmness of contact at the top as attained by the wedges beneath, the head is drawn tightly up against the nuts by the locking screw *L*, which is supported by its head resting upon the yoke *Y*, its lower end being screwed into the head *H*. The yoke is kept in position in relation to the columns by sliding freely upon tenon-like extensions of the same extending up through it. The screw *L* serves incidentally as an axis for the pinion, and is feathered to the same by a pin-feather sliding in a key-seat which is of considerably greater width than is the feather itself. This construction allows *L* to be driven by the pinion, when the same is revolved to adjust the nuts, so that each keeps pace with the other, and it also allows *L* to be turned separately afterwards (taking up part of the lost motion of the feather in the key-seat) to give a final clamping or locking action by drawing the head hard up against the nuts *N N*. That the vertical motions may be kept in time with each other, the pinion is one-half the diameter of the gear nuts and the pitch of the screw on *L* is one-half the pitch of that on the columns. Both *L* and the pinion are operated by the same plain pin-wrench, which is shown lying on the floor.

The ram of the machine *R*, sliding upon the columns, is made with a length of bearing of 30 inches, that it may be rigid and accurate in its motions. It is driven upward from beneath with heavy gun-iron toggles, having a width of bearing on their pins of some 14 inches, the pins themselves being of hardened and ground tool steel, 3½ inches in diameter. The descent of the ram is normally accomplished by its own weight, assisted, when necessary, by a heavy adjustable spring at the rear. The toggles are also provided with pull-rings, inserted in annular grooves eccentric with the pins, for abnormal stresses which may occasionally occur by work sticking in the dies. Ordinarily, however, these rings have no work to do. The toggles are operated, as shown, by a pitman *P* from the main shaft *S*. It will be noticed in Fig. 2 that the pitman, toggles, pins and also the shoes above and below the toggles, against which they thrust, can all be quickly removed by taking out four ordinary bolts in front, and the four bolts of the pitman cap behind, and this without disturbing any of the other parts of the machine.

The ram is made in two parts, so as to get accurate adjustment for wear and

that it may rapidly be removed without disturbing the columns. The front plate of the same is held firmly in position by four large, hollow, sleeve-like set-screws, which are screwed through the plate and which rest against the body of the ram. Inside of these large screws are four heavy studs, screwed into the ram, which are provided with nuts at the forward end bearing against cup-like washers, which, in their turn, rest against the ram plate. At the side of these washers are slots through which to operate the set-screws. Thus, in result, the back surface of the ram plate formed by the ends of the set-screws becomes an adjustable one, giving the effect of solid metal with the elastic yield taken care of when the four main nuts are firmly tightened.

The main shaft is driven by a cut gear *G*, having a diameter of 60 inches and a face of 9 inches, this gear being firmly keyed to the shaft—rather than connected with a clutch, as is usual in smaller presses. This gear, in its turn, is driven by a twelve-tooth steel pinion, forged solid upon a second shaft *S'*, giving a ratio of 10 to 1. This second shaft is provided with a flywheel keyed fast to it at one end and a newly designed friction clutch at the other end. This clutch is of the automatic-stop variety, and is thrown out of gear and locked in that position by a cam upon the main shaft. To start the press, the clutch lever is unlocked by depressing the treadle *T*, or by pulling forward a handle above, which is attached to the same. By unlocking a set-screw and slipping the cam referred to off the shaft, the press may be run continuously, if desired.

The ram and the head of the press are shown provided with a bolster and a chuck, respectively, for holding lower and upper dies. These may be removed and any other fastenings substituted. As shown in Fig. 2, the bolster and the head are provided with hardened and ground steel plates, firmly fastened into them, that there may be hard surfaces for resisting heavy pressures thrust upon them by the dies.

In general, it will be noticed that the frame-piece *F* is firmly fastened to the base with four heavy bolts and also to the columns with four other heavy bolts, these latter taking the thrust of the pitman. The columns, however, are not tapped sufficiently deep to weaken their cross-section, beyond what they are already weakened by the necessary screw-threads at their upper ends. These columns are 7½ inches in diameter and made of Bethlehem forgings of about .50 carbon. They are, of course, vastly stronger than any strain that can be put upon them by the mechanism of the press. The main shaft is of the same quality of steel, being enlarged in the center, with the crank of considerably greater diameter than the journals, as should be the case with all such constructions, to cover the contour of a parabolic beam. The total hight of the machine is about 112 inches, and the hight from top of ram to bottom of head, with stroke of ram down and adjustment of head up, is 18 inches. The clear distance between columns is 18½ inches.

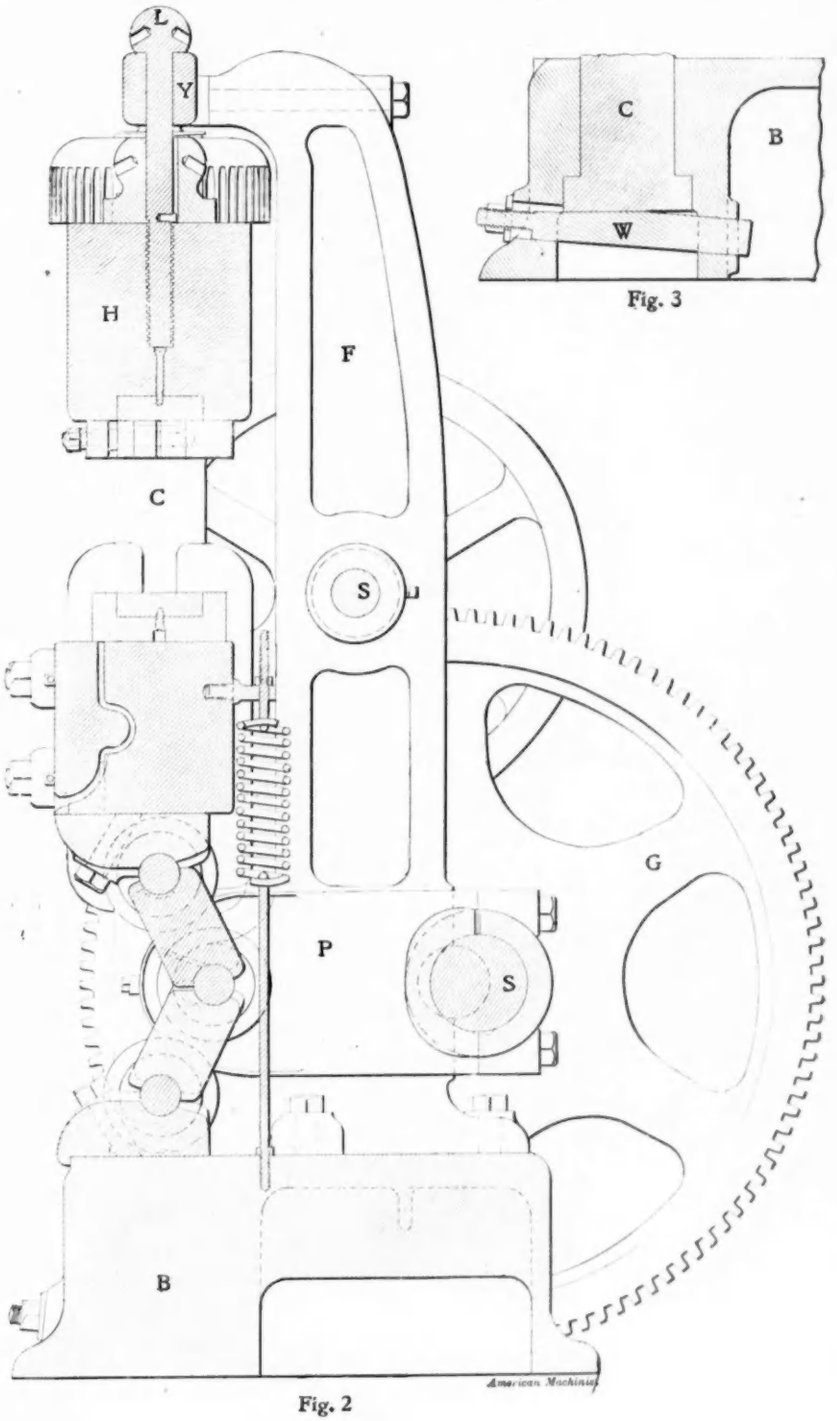


Fig. 2

SECTION OF TOGGLE JOINT PRESS.

Fig. 3

The Design of Oil Slings.

BY EDWIN RUST DOUGLAS.

The designer of high-speed machinery has often to consider the prevention of oil-throwing by shafts and collars, or at least the provision of means for minimizing it. His usual device is a groove turned in the shaft or collar near the journal to check the creeping oil, and an encircling lip projecting from the bearing to catch and carry off any oil that may be thrown from the edges of the groove. Although simple in its conception, there seems to be no real understanding of the actions involved and no commonly accepted form of groove or lip. Consequently, there is sometimes a lamentable failure of the device to perform its func-

tions. To find the causes of the failure, and to determine the preventive, the following experiments were undertaken.

A standard ring-oiling babbitted journal box, *A*, Fig. 1, 2¾x6 inches, was supported in a suitable framework *B* and provided with oil supply *C*. In this box was run, by an electric motor connected at *D*, a stub shaft *E*, on which could be mounted for trial oil slinging collars *F*, of any desired form. Oil lips of various styles were provided for attachment to the frame at *G*.

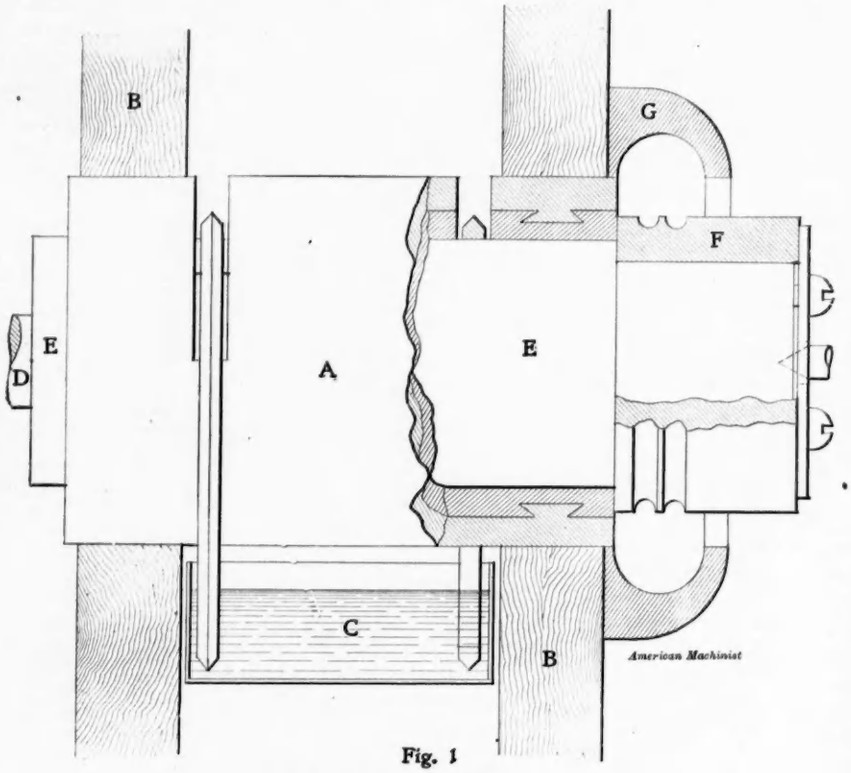


Fig. 1

EXPERIMENT WITH OIL SLINGS.

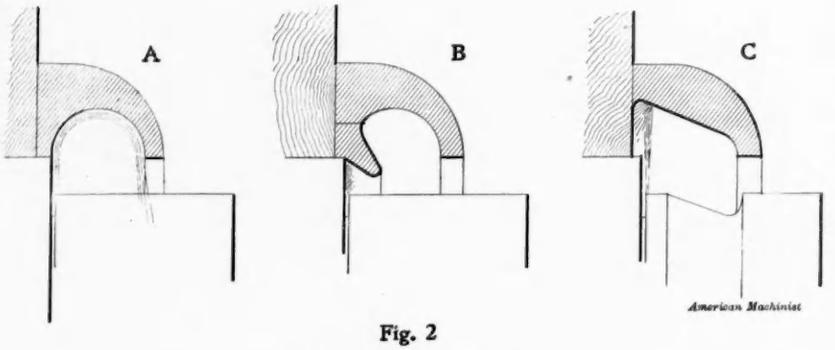


Fig. 2

DIFFERENT FORMS OF LIP.

The speed of the shaft could be maintained at any value up to about 1,200 revolutions per minute.

The first experiments were to determine the creeping of oil along the surfaces of shafts. The results indicate that, while a film of oil will spread some distance from the bearing, it will not do so in sufficient quantity to cause oil throwing, even on starting a shaft that has been some time at rest. These results were obtained with a ring oiling bearing. If oil were supplied continuously in such quantities as to cause dripping from a loosely fitting journal box, of course the above remark would not apply.

It was found that oil would work under a tightly fitting collar faster and in much greater quantity than it would creep over the outer surface, so that such a collar might, indeed, lead to the very condition it was intended to prevent.

The throwing of oil from a conical surface depends on the viscosity of the oil, the speed of rotation, the distance from the axis, and the inclination of the surface. It was found that using a good quality of dynamo oil, a drop placed on a conical surface whose inclination to the axis was 15 degrees or over, at a distance from the axis of about 1½ inches, would, at speeds of 400 revolutions per minute and over, be thrown outward along the surface. The sharpness of the angle from which the oil was to be thrown appeared to have very little effect, provided the surfaces forming it were steep enough to cause the oil to creep.

The experiments so far described were regarded as merely preliminary to others investigating the actual throwing of oil from a shaft under conditions similar to those which prevail in practice. With the apparatus used it was at first found difficult to produce any throwing at all, nor was it obtained until the babbitt had been scraped to a rather loose fit. Then, the collar *F* being tightly pressed against the end of the journal box, a film of oil was drawn out between the two, forming a scarcely visible ring in the outer angle, none being thrown off. As the shaft and collar were slowly drawn out from the journal box this film of oil became thicker, and that part next the collar rotated at higher speed, projecting in a ring from its edge, until, at a separation of about .02 inch, it suddenly broke, deluging the surroundings and the too intent investigator in a spray of oil. This continued until the separation was about .03 inch, when the film of oil in the gap could no longer be maintained and the spray suddenly ceased, nor could it be reinduced without repeating operations from the beginning. At wider separations nothing happened, but at this critical distance the spray, once established, would continue unabated as long as oil was supplied.

If the shaft were caused to play back and forth, the collar each time bumping against the end of the box, the film would be formed, broken and re-established periodically, giving a spatter of oil after every bump. But when the spray was unimpeded by oil lips, there was in no instance, either with oil slinging grooves or with a straight collar, found any creeping of the oil or any throwing from any part of the collar except the corner next the box. The question still remained, why visible oil throwing should occur when the end of the bearing was provided with a projecting lip, supposed to catch the spray and carry it off.

To answer this, three oil lips were prepared for attachment, as shown at *G*, Fig. 1. These lips are illustrated as *A*, *B*, *C*, Fig. 2. *A* is a form not uncommonly used.

A spray having been established from the edge of the collar, lip *A* was put in place. Its apparent effect was to transfer the source of the spray from the edge of the collar to a place farther out, just beyond the lip; but closer inspection showed that this oil did not come from there, but was the original spray, which turned in direction, after pursuing a helical course around the inside surface of the lip, as shown in dotted line, Fig. 2, issued violently and only slightly diminished in amount about the shaft. Some of it fell on the shaft and was thrown off.

On adding a small inner lip, as shown

at *B*, Fig. 2, the slinging entirely stopped. This led to the construction of a lip as shown at *C*, of such an internal form as to turn the spray of oil in toward the bearing instead of out. With this, also, the visible throwing of oil ceased entirely, nor did any trace of it appear on the shaft or surroundings during several hours' run, though all that time the spray was uninterrupted.

As a result of these experiments, the form of oil sling and lip shown at *C*, Fig. 2, may be considered as best to satisfy the usual conditions; the lip as preventing any spray from escaping, the oil sling as furnishing, by its inclined surface, a means of leading inwardly any stray drops that may fall from the inside of the lip.

The Construction of the Curve $P V^n = C$.

The construction for the curve $p\ v^n = c$ given in the "American Machinist," No. 22, is certainly ingenious. There is, however, a far simpler method given in "Des Ingenieurs Taschenbuch Hütte," which I have never happened to run across in any American textbook, and I therefore offer it for your attention, together with a proof.

The general form of the exponential equation is $p_1 v_1^n = p_2 v_2^n$, but as the terms of one member are known, it may be conveniently written $p\ v^n = c$, the form which Prof. Low chose. Given the pressure p_1 and the volume v_1, one point *A* of the curve is known, and the problem is to locate other points as *E* corresponding to a pressure p_2 and volume v_2. Draw a line *O J*, making any convenient angle α with the axis *O X*. From the relation

$$1 + \tan.\ \beta = [1 + \tan.\ \alpha]^n$$

determine β and lay off *O C*, making the angle β with *O Y*. Draw *A B* parallel to *O X* and *A J* parallel to *O Y*. Lay off *B C* at an angle of 45 degrees with *O Y*, and from the intersection of *B C* and *O C* draw a horizontal line *C E*. From the intersection of *A J* and *O J* draw a line at 45 degrees with *O X* and cutting *O X* at *H*. At *H* erect a perpendicular cutting *C E* at *E* and *O J* produced at J_1. Then *E* is a point on the curve, and so proceed. The smaller the angle α is taken the more closely the points of the curve will be located.

Conversely, if we have a curve for which we wish to derive an exponent, we can, by working backward, locate the lines *O C* and *O J*, measure the angles α and β, and solve for *n*.

PROOF.

$E F = G H = G J = O G \tan.\ \alpha = v_1 \tan.\ \alpha$ and $v_2 = D E = D F + E F = A B + E F = v_1 + v_1 \tan.\ \alpha = v_1 (1 + \tan.\ \alpha)$, or

$$v_2^n = v_1^n (1 + \tan.\ \alpha)^n \qquad (1)$$

$A F = B D = C D = O D \tan.\ \beta = p_2 \tan.\ \beta$ and $p_2 = E H = A G - A F = p_1 - p_2 \tan.\ \beta$, or

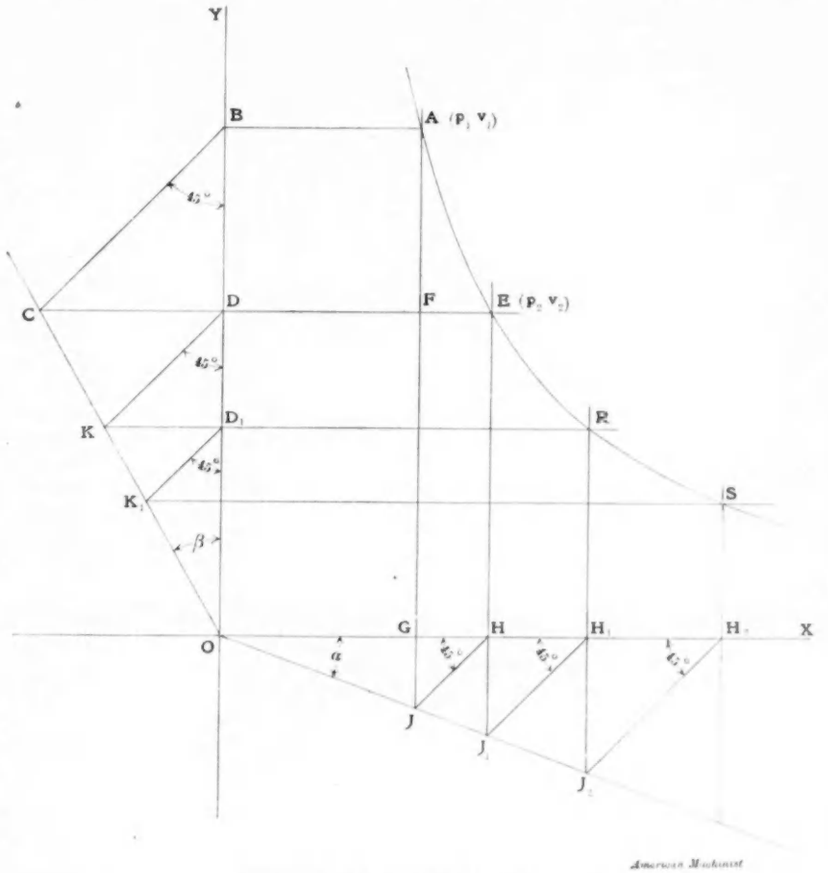
$$p_1 = p_2 (1 + \tan.\ \beta) \qquad (2)$$

Multiplying together (1) and (2), we obtain

$$p_2 v_2^n (1 + \tan.\ \beta) = p_1 v_1^n (1 + \tan.\ \alpha)^n \qquad (3)$$

But we began the construction with the assumption that $[1 + \tan.\ \beta] = [1 + \tan.\ \alpha]^n$, and hence these factors in (3) cancel out, and we have $p_1 v_1^n = p_2 v_2^n$ for the equation of the curve which we have plotted. G. A. H.

[This is the neatest and simplest method of laying out this curve that we have seen. A leading field of usefulness for it is, of course, the laying out of the adiabatic curve on indicator diagrams from air compressors, for which case $n = 1.41$. Taking this value for *n*, and making $\alpha = 15$ degrees, we find $\beta = 21$ degrees 30 minutes, and a memorandum of these angles is all that is necessary to enable anyone to lay out the curve. It is obvious that by taking $\alpha = \beta$, the same construction would give the isothermal curve, and in this manner the two curves can be easily laid down and compared on the same diagram. It would be a simple matter for anyone having much of this work to do to calculate a table of values for α and β corresponding to various values for *n*, which would answer all ordinary requirements.—Ed.]



CONSTRUCTION OF THE ADIABATIC CURVE.

Blast-furnace gas is used in gas engines in Germany to the extent of 22,000 horse-power. In Belgium engines of 3,700, in France of 3,250, and in England of 2,060 horse-power are so operated.

The Working Machinist's Opportunities.

BY F. A. STANLEY.

Do all shop men make the most of the opportunities they have for acquiring knowledge on mechanical and other subjects? There are some of them who say that a fellow who gets into the drawing room is all right and has unlimited chances ahead of him, but that the man who has to stick to a lathe or planer or boring mill gets little opportunity to learn anything except in connection with the piece of work that he happens to have in his machine. Now, it is my experience that the man in the shop has a great deal of time while his machine is in operation to think over and work up many ideas of more or less usefulness, and to reason out the why and the wherefore of many things that may have appeared mysterious to him. It would seem that in this respect he has a decided advantage over the draftsman, for the latter, if he is to make any progress with his work, has to concentrate every thought upon the job he has on the board, and every moment that he spends in thinking about that new tool he is going to patent, or that problem he was studying the night before in one of the technical papers, is just so much time taken away from his work. He can't push his triangle up against the T-square, lay a couple of lead pencils near the triangle,

and then pull a lever and have the drawing made automatically for him while he waits, he in the meanwhile occupying his mind with something perhaps foreign to the matter in hand, or rather on the board.

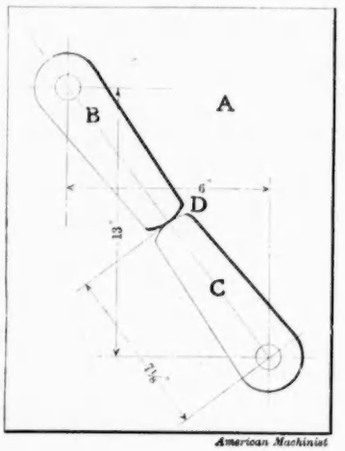
The machinist, on the other hand, has on a good deal of his work considerable time between the setting and the removing of his job, to be used in some way or other. This doesn't refer to those shops where a man runs two lathes on work ½ inch in diameter and 3 inches long, but to places where the work is fairly good-sized, and where after a cut is on there is nothing to do but to while away the time for an hour or two, more or less. What better chance could a man have for considering the various problems that arise in machine construction; whether his particular job could be machined in a cheaper and better way with some particular tool to assist in the undertaking; whether the present machine could be improved in any way, and if so, how? And along with the consideration of an endless variety of details that go to make up an interesting business, some little thought about that pet scheme which is going to alter some very material part of the machine trade.

It seems as if the machinist might readily become as proficient in ordinary mathematical calculation as the draftsman; for though all working dimensions, angles, etc., are figured on the drawing, and he is therefore not obliged to work them out, still when the job is once well under headway he often has a good chance, with the drawing at hand, to go over it and calculate why, certain dimensions being so and so, other figures must necessarily be what they are. To do this, of course, a knowledge of simple mathematics is necessary, but it seems nowadays that there is little excuse for anyone being unable to work out ordinary examples in simple arithmetic. And with a little for a start, it is surprising how much can be added to one's knowledge of any subject, if proper attention be paid to it.

Some years ago, while running a planer, I was lucky enough to be working with a man who was a great hand to spring problems on us younger fellows. Our work at that time required little attention for an hour or two at a time, and in the meanwhile we wrestled with many an interesting example. All the problems were directly connected with some of the work we were doing, or that was being done somewhere about the place, and were particularly instructive in that they showed us the practical application of mathematics. There are many men with a fair schooling who seem to be unable to apply their knowledge of mathematics to shop practice, or who, if able, do not do so for some reason or other.

In certain shops where I have spent considerable time there is much in the way of calculation left to the men who are to do the job, and what better experience could a man ask for? True, it is not economy, in one sense, to let a drawing go into the shop minus any working figures; but there are places that could be named where the man with a mathematical mind has full opportunity to use it. In a jobbing shop, where special work is always coming in, often with the merest shadow of a drawing or sketch, what an opening for a man to figure out some of the missing links. If he cannot do it, why it's a case of looking up the foreman and bothering him, and then, perhaps, going to the office and having it worked out there.

Now, there's the subject of gearing. How many men there are who are frightened whenever the subject is touched upon. Perhaps they have made a few spur gears some time or other; but the job was a somewhat mysterious one to them. Even some of the best of the so-called all around sort of men appear totally ignorant of the relations existing between pitch diameter, diametral pitch, etc.; yet the explanation of the terms relating to gearing and all the rules for calculating the various dimensions are within the reach of every machinist. Probably there are few men to-day who have not in their tool chest copies of the "Brown & Sharpe" catalog, and this contains in a few paragraphs all the instruction needed for figuring the size of blanks, cutting the teeth, etc.; thus helping to lay an excellent foundation for anyone who wishes to make a special study of the subject.



The next time there's a "loafing job" on the planer or in the lathe, just take a look at the "Sizing and Cutting of Gears" in the Brown & Sharpe catalog, and I'll guarantee that, with a little careful attention to the few rules and explanations laid down there, you'll learn a lot about a subject that many of us have been a little shy of. And the next time an old gear skeleton comes in shorn of most of its teeth, and you are asked to turn up and cut another to replace it, you won't have to go to someone else to find out how large it wants to be turned, how many teeth to cut, and what pitch to cut them.

While speaking of jobbing shops, once upon a time a man came in with a sketch something like the foregoing.

The plate *A* was to carry two crank-shaped arms *B* and *C*, which were to come in contact at point *D*. The workman who was given the job was a pretty bright mechanic, and when he had bored the holes at 6 and 13-inch centers as shown, made the two arms to the length given on the sketch, 7⅛ inches, and dropped their hubs into the holes in the plate, he was somewhat surprised to find the ends were a long distance apart; that is, a long way considered in thousandths of an inch. Not being able to find any error in his layout on the plate, he concluded that the diagonal distance had been figured incorrectly and the arms made too short on the drawing, and this was just the place where he had to call for help, for while he could measure across and get the distance very closely, he did not know how to figure it out and obtain it exact. A few figures soon demonstrated the fact that there had been an error in the drawing, and the workman was surprised to find it so easily worked out by arithmetic. He said he had studied square root and had thought he understood it, but had never been taught that it had any such practical application as in the present case. It is safe to say that since that time he has found many uses for square root, and that, like all other mathematical processes, the more it is used the handier it is and the more uses there are found for it. The foregoing incident is mentioned to illustrate the fact that too many of us, with something of a common school education, are apt to forget that we have opportunities to make practical use of it in everyday work.

Graphic Method of Balancing Marine Engines.*

BY J. MACFARLANE GRAY.

The problem of the *inertia* effect of the reciprocating masses in the steam engine has been already dealt with by me in the Transactions of the Institution of Naval Architects for 1886, at page 331, and again in 1897, in my paper, "The Accelerity Diagram of the Steam Engine." Mr. Mallock has also given a correct graphic method and the mathematical investigation in his excellent paper, "On the Vibrations of Ships and Engines," in the Transactions for 1895. The paper by Herr Otto Schlick, this year, reproduces the expressions for the reactions given in those papers, and presents a much-elaborated discussion of the mathematical relations subsisting between the various weights, angles and distances in the problem, with the object of narrowing the field of search for a perfectly balanced engine.

According to my 1897 paper, the vertical reaction is

* From "Engineering," London.

$$\frac{R_w^2}{g} \left\{ \begin{array}{l} \cos.\ \phi\,(A\cos.\ a + \&c.) \\ \sin.\ \phi\,(A\sin.\ a + \&c.) \\ +\frac{1}{n}\cos.2\,\phi\,(A\cos.2a + \&c.) \\ +\frac{1}{n}\sin.2\,\phi\,(A\sin.\ 2a + \&c.) \end{array} \right. \text{ or } \left\{ \begin{array}{l} E \\ +F \\ +G \\ +H \end{array} \right.$$

(in Mr. Schlick's paper).

The same expression stands for the tilting movements, only substituting the moment of each weight, A', B', etc., for the weights A, B, etc., in the formula. Each line is extended to include every crank, thus: $A\cos.\ a + B\cos.\ b + C\cos.\ c$, etc.

To get a balanced engine, the reactions must be, as far as possible, reduced to nothing. When reactions are represented as in my diagram of 1897, the effect of the obliquity can be clearly measured. To get the reactions, primary and secondary on one line, I here alter the rosette diagram of obliquity at the expense of the accuracy of measuring. The diagram of reaction is as in Fig. 6. The vector lines are drawn through the center O terminated by the intersections on the circle and on the rosette, for nearly one-fourth of one revolution. The dotted line $O\,M$ denotes the position of maximum velocity of piston. The vectors would confuse the diagram if more were drawn. The same method applies to the reaction vectors all round. The abrupt effect of the obliquity is obvious, and it is clear that the primary reactions shown by the circles cannot be accommodated to balance the obliquity reactions shown by the rosette. Therefore, to balance, each set of reactions must be dealt with by itself. The primary reactions, must themselves cancel out, and the obliquity or secondary reactions must also themselves cancel out.

The primary reactions are *nil* if the polygon of weights and the polygon of moments are both closed figures.

In Fig. 1, $A\ B\ C\ D$ is any polygon of weights for the cranks as shown at the corner. Observe that the sides are drawn, in succession, each parallel to its crank and in the sense of "outward from the shaft." Produce B along B' and make $B' = B$. Produce D along D' and draw C' parallel to C. This is the diagram for primary balancing. The figure $A'\ B'\ C'\ D'$ is the polygon of moments.

Regard the cylinders as arranged in Fig. 2. The point O is midway between A and B and the length $O\,A$ or $O\,B$ will be now called unity, or 1. The distances $O\,C$, $O\,D$ will be m and n, fractions of $O\,A$.

The trick of this diagram lies in making $O\,A = 1$, for by doing so we can represent the moment of A and the moment of B, by the lengths of A and B. Therefore in the moments-polygon, A is also A' and $B' = B$. By construction, C' is parallel with C, and also D' with D, because it is in the same line. Evidently, to make C' right, the distance $O\,C$ must be $\frac{C'}{C} = m$. Also, to make D' right, the distance $O\,D$ must be $\frac{D'}{D} = n$. This means that these distances are actually $O\,C = \frac{C'}{C} \times O\,A$, and $O\,D = \frac{D'}{D} \times O\,A$.

The consecutive arrows on the sides of the two polygons are in the same direction, on the corresponding sides, for the cylinders on one side of the central plane, and in opposite directions, for the cylinders on the other side of the plane. Thus, $A'\ A$ and $C'\ C$ indicate one side, and $D'\ D$ the other.

If the weights and angles are not yet settled, use laths for the sides, jointed with wire nails, as in Fig. 3. Add a side $K = 2\,B$ to form a parallel frame with C' and C. Leave out one of the joint pins, say the one at the corner $C\ C$, and the diagram, Fig. 1, can be played into other forms, say into Fig. 3, giving new values for C' and D', and a new set of crank angles.

That Fig. 1 or Fig. 3 is a valid diagram for a complete balance of the lifting forces and the tilting moments requires no demonstration, the proof is on the face of it.

Observe that in these diagrams there has been no restriction as to weights or angles, and I have not been careful to think whether the lengths employed would be suitable for an engine. I am now only exemplifying the method.

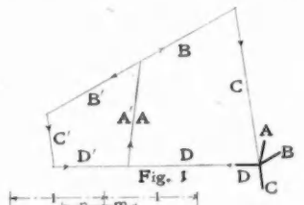


Fig. 1

Fig. 2

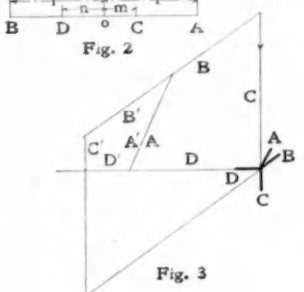


Fig. 3

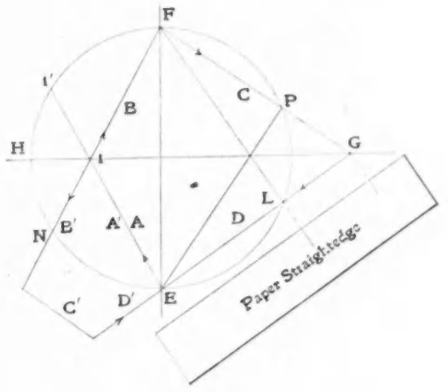


Fig. 4

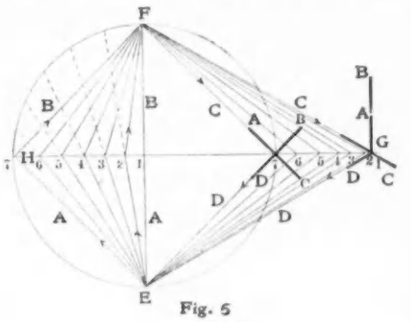


Fig. 5

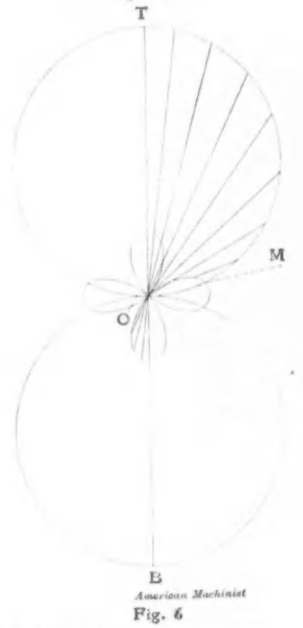


Fig. 6

GRAPHIC METHOD OF BALANCING ENGINES.

When we come to the balancing of the secondary reactions there is a limitation upon our selection of lengths on the diagram. Herr Schlick was the first to point out that cancellation of the primary reactions due to lifting and tilting and the obliquity reaction of lifting could be attained by arranging the crank angles and weights symmetrically, the outer cylinders having their cranks on one side and the inner cylinders having their cranks on the other side of the normal to the axis of symmetry. The paper by Herr Schlick deals with the settlement of angles, weights and positions of cylinders within this limitation. I will now give a simple graphic determination of the proper angles, weights and distances for any desired fixed conditions, with Herr Schlick's symmetry limitation.

In Fig. 4 describe a circle, of any diameter, and draw the rectangular center lines. It is required to find a polygon of forces A, B, C, D that will give cancellation of obliquity effect for the lifting forces. The quadrilateral $E\ 4\ F\ G$ is a valid polygon of this character. The only criterion of determination here is, that on the line $E\ 4\ 4$ the length $4\ 4'$ should be equal to the length $L\ G$ on the line $E\ G$. To get this, say that $E\ G$ is given, apply a paper straight-edge to $E\ G$, and mark on it the points L and G; apply the

straight-edge as $E\ 4'$, to the point E with the marks one upon the line $H\ G$ at 4, and the other on the circle at $4'$. The line A is thus obtained, and the equal line $4\ F$ will be B, and the line $F\ G$ will be C. This is the only polygon of weights that will form a balanced system including $E\ G$, the given D. The diagram is then completed, as shown in this figure, as described under Fig. 1, and an engine constructed accordingly will be perfectly balanced for the primary vertical and the primary tilting reactions and also for the vertical reaction arising from obliquity.

The diagram can now be read as one complete polygon, but as the lettering has not been provided for this in the engravings, I reserve further remarks on this until another occasion.

The proof of this solution is obtained by writing out the conditions of balancing as given in my 1897 paper, and also denoted by G and H in Herr Schlick's paper, and beneath them the same equations in terms of the lengths on this diagram:

$$\left.\begin{aligned} &G = A\cos.\ 2a + B\cos.\ 2b + C\cos.\ 2c + D\cos.\ 2d = 0, \\ \text{or}\quad &N\,4 + 4\,4' - L\,G - P\,G = 0. \end{aligned}\right\}$$

$$\left.\begin{aligned} &H = A\sin.\ 2a + B\sin.\ 2b + C\sin.\ 2c + D\sin.\ 2d = 0, \\ \text{or}\quad &N\,E + F\,4 - F\,L - E\,P = 0. \end{aligned}\right\}$$

That the trigonometrical expressions correspond identically with the geometrical references is not so clear that one may read as he runs, and whoever desires to fathom it must quietly look into the diagrams, doubling the angles as he proceeds.

In Fig. 5 a number of sets of valid angles for balancing are given, all drawn as has just been explained, using the paper straight-edge. At the one extreme the outer cranks are set at the same angle, and the crank line of double length at G denotes that there are two cranks at that angle. At the other limit the polygon of forces is a square, and the crank weights are all the same.

If it be desired to balance the obliquity tilting as well as the primary tilting, and the primary vertical forces, the balancing of the obliquity vertical forces must be abandoned, and the construction must begin with the determination of the angles in the trapezium $A'\ B'\ C'\ D'$ precisely as has been explained for $A\ B\ C\ D$. The arrangement of cylinders will then be found to be altered, and the diagram will show how.

I have carried out this graphic method to include the delineation of the residual unbalanced obliquity tilting reaction; I will, perhaps, add that to this paper.

Gem Village, Pa., has a Pooh Bah. W. H. Peck is postmaster, jeweler, blacksmith, carpenter, wagon-maker, sawmill operator and Justice of the Peace. He also does painting and plastering and fixes watches, clocks and bicycles.

Letters from Practical Men

The Driving of Inventors.

Editor American Machinist:

And so Harris Tabor retires from business. He retires as a successful inventor; an inventor whose devices have proved themselves practical successes, so that they have established themselves in extensive daily use, so that they enable many men to do certain important and necessary operations more accurately and expeditiously and more cheaply than ever before. But he is also, as I understand, a successful inventor in that rarer sense that, while he has not, perhaps, become a multi-millionaire or a bloated bondholder, he has at least so successfully marketed his inventions that they have brought him some substantial remuneration beyond his hand-to-mouth needs. For all this he is to be most heartily congratulated, and the best wishes of all must be extended to him for his future happiness and prosperity.

While these congratulations are going on we must not forget to congratulate ourselves also, the mechanical world, upon our acquisition of some valuable inventions that have augmented our facilities and quickened and lightened our work, so that we are the gainers more emphatically than is the individual inventor. An inventor, so that he does the true work of an inventor, can never make a one-sided bargain with the world to his exclusive advantage, while the instances in which the ultimate gain has all been on the other side are all too common.

"Now, let's see. One of his inventions is the Tabor indicator. That's the one that has the curious crooked little slot in the piston connection to make the pencil travel right. Why didn't I think of that, so that I might have been the fellow to retire and take a rest?" You will please notice that these are not my words, but they are just what some fellows are pretty sure to be saying. It is a very common way of looking at such things, and it seems to be applicable to all sizes of inventions. Many have thought and spoken in the same way of the Corliss engine. The Corliss releasing gear is the one special trick that all catch on to when they see the Corliss engine, and many pseudo inventors have said, and more have thought, that if each individual of them could only have thought of the automatic cut-off he might have been a George Corliss; it was only a matter of luck that Corliss came before and shut him off.

Now, when the patent first came out for the Corliss releasing gear I haven't the slightest idea that anyone offered him a cent for it, or that anyone noticed it as having any value. His life work began, instead of ended, with the invention of the valve gear. He, in fact, redesigned the steam engine of his day, and, in his way of introducing his engine by bargaining on the saving of fuel, he took advantage of every point in the boiler conditions as well, so that, instead of being easily floated to success by the ingenuity embodied in one mechanical movement, he had to know and newly apply all that was then known about every detail of steam action and steam engine practice, and add a little here and a little there to make a revolutionary success of the whole.

So the patent on the Tabor indicator has, no doubt, served to identify and secure it to its inventor and manufacturers, but the mere invention of the curved slot is no measure or indication of the brain work that must have been put on the indicator before it was ready for the market at all. When it came out it was not merely another indicator with a different pencil movement, but it was a new indicator of which the pencil movement was an incidental part. The entire indicator had been redesigned, rearranged, changed and improved in details of design and in precision and perfection of manufacture.

The amount of work that the successful inventor has to pay as the price of his success is perhaps more distinctly suggested in the history and progress of the Tabor molding machine. I know nothing of the patents on the machine, and I suppose that the general public has had no specific knowledge of these patents thrust upon them. I do know that very much is embodied in the machine that no patents cover, and that no patents can be made to cover. We are told that the machine has been illustrated and described in the columns of the "American Machinist" four times, the first appearing more than ten years ago, while the machine had been in use some years before the public were told of it at all. Each successive exhibition of it showed a very different machine from the preceding, so that through all the intervening years the process of invention and improvement had gone on. The progress of this machine has been not that of piling invention upon invention, with the result of increasing complication, but rather the superseding of one device or process by another, and a continual simplification of the whole, so that the price of the latest machine is perhaps not more than a quarter the price of the first one, but more than ten times as many must now find a market. This machine, then, very distinctly does not represent one single happy thought, nor a few of such in combination, but years of continued and persistent seeking and planning in a single direction. The work has been at least long if it has not all been hard, and the rest at last has been well earned.

I can't say that I altogether believe in the "retirement" of an inventor in the fulness of his powers. The intention may be announced in all sincerity, but it is not, after all, such an easy thing for an inventor to do, and such fellows are not much in the habit of doing it. Grocers and bankers, who follow their calling

solely for the getting of money, may and do drop it, but inventors are driven by more complex motives, and it is not so easy for them to stop. Their machinery, I imagine, is speeded higher and has more momentum. The inventor's mind has an automatic attachment that often keeps it going in spite of him. The work of the common man is the dragging of load after load over a road every step of which is familiar to him. The inventor travels a new path continually, and ever as he advances new objects still entice him along. He may take a notion to sit down and rest, but something ahead is quite likely to attract his eye and start him again. It will be no surprise to me certainly if we find that the inventor of the Tabor indicator and the Tabor molding machine, and of several other not unsuccessful inventions which are not so well known, has been driven to other inventions in spite of himself.

TECUMSEH SWIFT.

Cast-Iron Wheels for High Speeds.

Editor American Machinist:

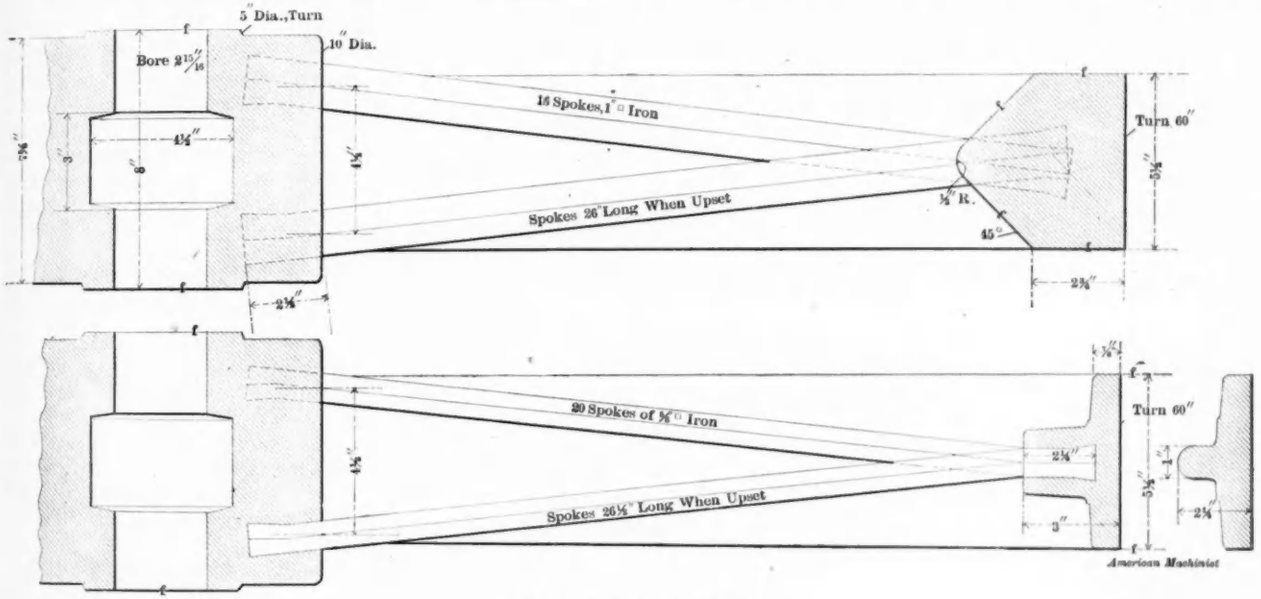
I notice in the "American Machinist," No. 20, a description of a driving wheel for band-saw mills which interests me, because I am engaged in a similar business, viz., making sawmill machinery.

For over ten years the shop with which I am connected has made cast-iron wheels for band-saws and cast all in one piece—no provision for shrinkage being made. The arms were staggered, starting from the *center* of the rim and diverging alternately to either end of hub. I do not know how many have been made—perhaps a hundred—but we never have heard of one breaking. They are 8 feet in diameter, weigh about 6,000 pounds, and usually run at 10,000 feet rim velocity per minute.

For the last four years we have used mainly wheels with cast-iron rim and hub, with wrought-iron arms—1¾ inches square for the 8-feet wheels—set "diamonding." These arms are upset at each end and carefully tinned as far as they enter the cast iron. They are also staggered. The rim is poured one day and the hub the next. There are over fifty of these running, and we have yet to hear of the first mishap to one of them.

There are sixteen arms of 1¾-inch square iron—not steel.

I enclose a sketch of a pair of wheels made in a similar way, only much smaller. They are 5 feet in diameter and the sixteen arms are as shown in sketch. The first one we made of this size has been running every day—except Sundays—for fourteen months at a rim velocity of 11,000 feet per minute, with no sign of weakness in any way.



ANOTHER HIGH-SPEED WHEEL.

The principal advantage of this style of wheel over the all cast-iron—aside from its greater strength—is that no sawdust adheres to it. At the close of the season they are as free from dust as when they left the shop, except for a little at the hub, where oil from the journal has collected it.

E. S. NEWTON.

The All-Round Man vs. the Specialist—Self-Advertising.

Editor American Machinist:

The other day I was in the same seat in the smoker with Bob Smith. Bob was somewhat perturbed and unusually silent, but after a few miles I got him to talking. "No, indeed. Health as good as ever it was. Simply doing a little figuring. Trying to find out honestly how much I am worth. Not tax dodging either; just a plain inquiry; not only as to what I have earned, but as to what I am capable of earning.

"My father was largely responsible for my training, and, to tell the truth, it is not quite settled in my own mind as to whether his theories were all wrong, or whether I have failed to properly carry them into practice. He was an engineer with a very high esteem for the machinist's trade. He had me in a machine shop when I ought, perhaps, to have been at school; the idea being that the shop would show me what schooling I needed of an advanced type, and that I would obtain it somehow, and appreciate it all the more on that account. It is a fact that I have had often to hunt for information that has been drilled into others as a matter of course in the routine of the higher school training, and it is equally true that I have carried the love for knowledge right along in the many branches of the craft to which you and I belong. That's the trouble. I have never stayed with any concern very long, a few years being ample, and I have then taken up a position with another firm. There is no machine shop tool in general use that I can't handle. I can do a fair job at the forge and I am a fair draftsman. Jenkins and I served our apprenticeship together. He stayed with the firm and went out erecting for them. On one of these trips he had an offer to stay and take charge of the plant. Accepted the offer, and will in a few years be able to retire from further toil if he wants to. Jenkins has no liking for the trade, has no textbooks or trade paper, or any of the things that I feel are essential; yet his special knowledge of that one branch would, I feel sure, allow him an equal chance with myself if each of us had to get a new job. We all talk about 'experience,' and there seems to be a common belief that this means a general acquaintance with the craft or profession; but, as a matter of fact, a smattering of the subject is of little value as a marketable commodity. I have my doubts about the all-round man so frequently desired by ad-

vertisers. It's dollars to doughnuts that when he applies for the job he will be offered considerably less than is paid for a planer hand, for example.

"Maybe I'm getting too pessimistic, but this is a personal affair. I have been with the Motor Machine Company for several years. The business has been gradually failing, and at last there was a dissolution of the partnership, and then I was invited to drop my shop work and boost the business up a little. I have borrowed a few advertising pointers from the "American Machinist," have gone after business a little more, placed a few agents, and we are considerably ahead of last year so far. I have to run up against old-time precedents and conservatism generally, but have got along smoothly. Now things have progressed so that the firm is likely to be again changed. Another man, or more, is to come in and handle the financial and outside interests; someone with a business training. I understand that business training means office practice, and an all-round mechanic, as I fear I am, cannot, of course, handle this to the best advantage.

"I don't take kindly to this. I think an all-round machinist should have the ability to make and sell machines, to originate and operate the several devices in factory and product. As a theory this is excellent, but in practice it fails lamentably, because all-round men are really too common for each to be exceptionally well paid. I am getting down to the belief, and I am being convinced against my wish, that the one-idea man, who can do one thing better than anyone else, gets more appreciation, in hard, cold cash, than the fellow who does about everything in an average style. And the aforesaid one-idea chap need not do that particular job a great deal better than the other fellows would do it; a little better may suffice; but it is necessary that he lets them all know it. Let him hide his light and it won't be seen. All things come to the man who waits, if he knows how to wait. What is advertising but shedding light on you and your goods?

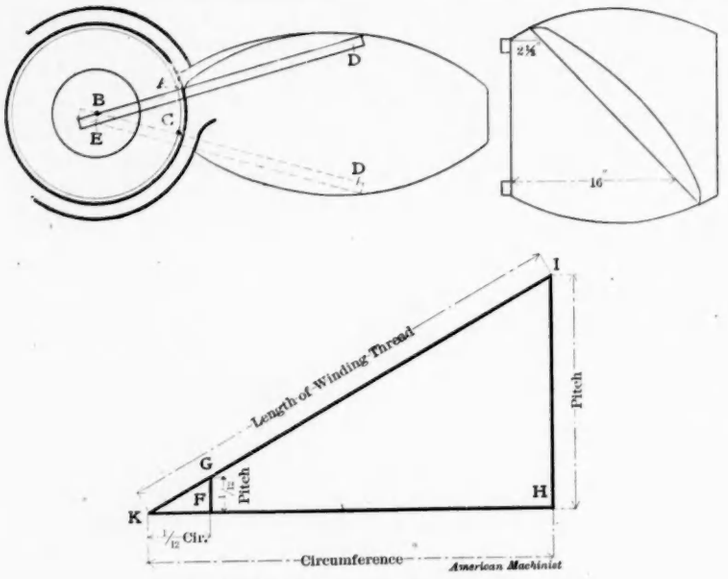
"Three or four years ago I met an immigrant whose work abroad had been in the making of leather slippers. He soon found that work of this sort was made altogether on a different plan here. He slipped back until, when I ran across him again, he was a helper in a machine shop. I brought him in contact with the superintendent of a concern making cameras, and his wages took a sudden jump. He had the one idea, but didn't know how to advertise it.

"There may be a place where my general knowledge would fit like a plug. I am going to study the 'American Machinist' more than ever. I have always studied over the practical men letters, until I feel that there are many twenty-foot walls that I could climb with a ten-foot ladder. And all of the other reading matter, provided it did not get too mathematical, I have read, even if I did not have time to thoroughly digest it. The advertisements have been useful in an educational way. If a certain style will attract my attention to another man's goods, why it's clear that a similar arrangement may obtain his attention to mine. There may be exceptions to this, but as I have either read or heard somewhere, the generality of mankind are like mankind in general. No, I am going to study the Wants. I may find out from the job that a man wants some reason, maybe, why the old job don't fit, and then again, just what kind of a firm is behind the advertisement that may strike my fancy. I am not yet out of a job, but after the reorganization this little inspection of the Wants will not, perhaps, be any more valueless than some of the other things known by the all-round man.

"Would I trade what general knowledge I have to become a specialist? Ah, there's the rub. Candidly, I don't think I would. I have come in contact, in the shop making sheet-metal goods, with an altogether different state of affairs to those I had with motor or engine building, and the nearer I got to a controlling interest in the shop the more did this acquaintance come in useful. But the employer is not likely to contemplate radical changes in the character of his product, and as an engine builder he will naturally prefer men who have been trained to build engines, and it is this very tendency that strikes against a high monetary reward for the all-round man.

"However, there are few all-around men, I dare say, who cannot do some one thing quite well. I don't think I belong to that small class, and I am going to look up my little points of superiority for the advertisement that may come along some of these days, and then"—

But here I asked him why it would not be easier to buy out the old firm, and Bob took on the perturbed look once more, and subsided into silence. "Q."



MEASURING THE PITCH OF A PROPELLER.

How to Measure the Pitch of a Screw Propeller.

Editor American Machinist:

The following is one of the methods employed in Scotland for finding the pitch of a screw propeller after it has been cast. Lay the propeller on the ground with the driving face up (that is, the straight or aftermost face of the blades); fit a piece of wood across the hole and mark the center of the bore. Chalk over the face of hub, and on it describe as large a circle as you can. Mark any point *A* on the circle, so that when you lay a straightedge on point *A* and center of circle *B*, it will be somewhere near the outer edge of the blade (as shown in sketch), where you intend to measure the pitch, as at *D*.

Now step off one-twelfth part of the circle from point *A*, which is quickly done by marking off the radius of the circle, thereby giving you one-sixth of the circumference, and then dividing this distance into two parts, say at point *C*. On the corner of the straightedge make two marks *E* and *D*, the distance apart to equal the radius at which you are to measure the pitch. Lay the straightedge on the face of the hub, making mark *E* coincide with center *B* and the corner to pass through point *A*. Measure the vertical distance in inches between the underside of the straightedge and the face of the blade at point *D*, and we will say it measures 2½ inches. Now swing the straightedge around until the same corner cuts point *C*, point *E* still being on center *B*. Measure the vertical distance again between the underside of the straightedge and the face of the blade at point *D*, and say we find it to be 16 inches. Now subtract the former vertical hight from the latter and your propeller will have as many

feet in pitch as there are inches in your measure—that is, 16 — 2½ inches = 13½ inches = 13½ feet in pitch.

The reason for the above method is: Since any screw is formed by a right-angled triangle wrapped around a cylinder, the base of said triangle will equal the circumference of the screw, the perpendicular will equal the pitch and the hypothenuse will equal the length of the winding thread. Now if we mark off a point F which will equal one-twelfth of the circumference *K H*, the vertical *F G* is equal to one-twelfth of the vertical *H I*. It can easily be seen that we have just measured off one-twelfth of the circumference where we measured our pitch, and we found the length of *F G* when we subtracted the vertical measure (16 — 2½ = 13½), which gave us one-twelfth of the actual pitch; but since there are 12 inches in 1 foot, it follows that every inch in our measure is equal to 1 foot of actual pitch. In other words, we have made our triangle to a scale of 1 inch to a foot. If your propeller is so small that one-twelfth of the circumference will not fall on the blade, then mark off one-sixteenth of the circle on the hub and proceed as before, taking care to multiply your result by 4 and divide the answer by 3. C. C. R.

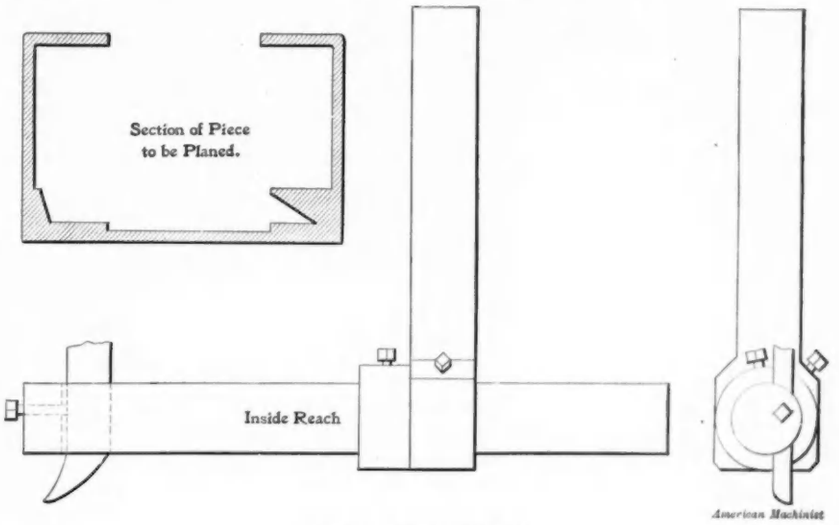
Adapting Pipe Patterns in a Jobbing Foundry.

Editor American Machinist:

Fig. 1 is an 8-inch pipe casting, with two 6-inch branches. Two of these were wanted in a hurry. Fig. 2 shows the two halves of an old pattern we had in stock, its dimensions being O. K. for the body of the casting required. Fig. 3 is a core box for forming the branches; the branch being placed in the center of the box, flange down, and the top of the box cut to fit the outside diameter of our stock pattern. The dimension *A B* in the core box being, of course, the distance *A B* in Fig 1. A strickle of suitable length was also made to go with this box. Fig. 4 is a half-round box for making the branch cores, two halves being pasted together for each branch. A loose piece *C*, cut to the radius of the main core, was pinned in this box the correct distance from the end.

When the cores were ready for use, the molder leveled up a bed in the floor, on which he set the cores for forming the branches, lining them up by laying a straight-edge along their sides. One half of the pattern was then laid on these cores, joint side up, and the branches located in their correct positions by lines previously laid out on the pattern by the pattern maker. The mold was then rammed up to the joint, and the other half of the pattern placed in position. The cope was then rammed up, lifted off and both halves of the pattern drawn. The branch cores were then set in the branches and centered by gage. Four spring chaplets kept them from shifting, and a little loose sand was sprinkled on their tops to insure the body core a good bearing when set, and the cope fastened down.

This operation is "as old as the hills," and for that reason I have only gone through it in a general way, but it may be new and prove of use to some of your readers. It gives excellent results, with a minimum amount of pattern work, and is common practice in shops doing this class of work. HOBO.

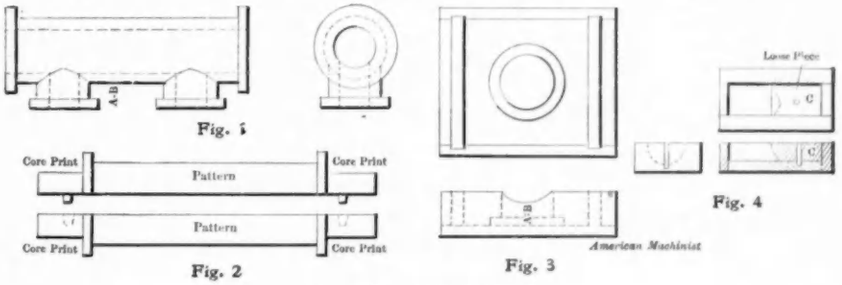


A HANDY PLANER REACH.

A Handy Planer Reach.

Editor American Machinist:

A bar of square iron about as heavy as will go between the bolts of a planer head, bent in the shape of an "L," and made a little longer than is required, can be seen in use in almost any old shop as a planer reach. In the sketch will be seen a reach that I found to be handy. It is about as easily made as the "L" shape, but is many more times convenient. The bar which holds the tool can be swung all around the circle, a movement that any planer hand can see the advantage of. The collar on the bar is intended to help hold the bar from slipping backward, and it also allows the bar to be set as short and stiff as the job will permit. It may also be noticed that with this style of reach the regular planer tools can be used, which means a saving of time in hunting around among the lathes or in waiting until the blacksmith can fix some up for you. The bar is cut out at a slight angle at the back of the tool, which prevents the tool from pushing out sideways. I found this tool to be cheaper to make than it would have been to have made five or six tools and grind them up. And now we have the reach. The sketch shows the job we had to reach into, about 14 inches. The job was a special one, and was to be used as a jig for boring milling machines at the R. K. Le Blond Machine Tool Company's, Cincinnati, O. H. L. C.



ADAPTING A PIPE PATTERN.

Foreign Trade Notes.

MACHINERY EXPORTS FOR THE LAST FISCAL YEAR.

The table printed in this week's number showing the exports of American machinery for the last fiscal year, which ended June 30, 1899, was compiled from the reports of the Bureau of Statistics, Treasury Department. We published most of the totals last August, but the distribution by countries as here shown came to hand only quite recently. The table is similar in form to one for the previous year given in the "American Machinist" for July 27, 1899, to which reference should be had for the purpose of comparison.

In addition to the kinds of machinery given in detail in the table and to the unclassified list, there were specified shoe machinery amounting to $853,936, and fire engines to $13,973. Cycles are not classed among machinery. With shoe machinery and fire engines included we compute the total of machinery exports to have been

Country to which Exported.	Metal Working Machinery.	Electrical Machinery.	Locomotive Engines.		Stationary Engines.	Boilers and parts of Engines.	Pumps and Pumping Machinery.	Printing Presses and parts thereof	Sewing Machines and parts thereof.	Typewriting Machines and parts thereof.	Unclassified Machinery (see explanation of table).
	Dollars.	Dollars.	No.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.
Austria-Hungary	118,483	5,960	.	.	.	86	39,537	.	7,305	31,907	85,081
Azores and Madeira Islands	.	.	.	.	.	.	19	.	192	100	1,117
Belgium	338,440	85,988	2	20,000	7,797	14,143	51,974	26,951	33,946	55,775	313,030
Denmark	9,209	1,706	9	78,270	10,393	712	35,073	2,759	2,210	13,550	221,941
France	741,285	219,905	.	.	8,451	6,428	182,425	1,100	95,953	160,357	698,723
Germany	2,638,403	279,618	6	43,835	3,819	8,060	294,270	24,756	688,980	507,000	1,285,541
Gibraltar	.	.	.	.	.	.	.	.	9	.	23
Greece	.	.	.	.	.	.	3,454	.	300	2,061	3,455
Greenland, Iceland, etc.	.	.	.	.	.	.	.	.	.	159	.
Italy	57,683	79,450	.	.	3,866	965	10,253	27,327	24,006	35,665	94,279
Netherlands	140,325	19,447	1	3,550	4,723	3,613	72,569	19,327	90,290	53,387	141,273
Portugal	165	14,102	.	.	.	.	1,561	200	.	.	1,897
Roumania	.	.	.	.	12,674	.	221	.	.	620	1,238
Russia—Baltic & White Seas	326,622	39,684	44	430,165	1,575	28,812	110,512	400	4,927	139,730	398,931
Black Sea	12,072	26,907	18	209,965	.	8,433	121,302	550	.	1,857	52,569
Spain	8,950	3,326	.	.	.	7	1,094	.	50	733	7,771
Sweden and Norway	155,237	12,036	23	212,575	9,411	8,533	33,613	14,483	488	18,744	319,467
Switzerland	32,425	1,458	.	.	.	.	798	.	677	25,210	13,761
Turkey in Europe	.	.	.	.	.	.	2,914	.	2,975	110	2,452
United Kingdom	1,681,547	864,678	25	281,493	13,165	75,855	751,526	424,431	956,424	1,054,060	3,198,185
Bermuda	165	.	.	.	1,335	2,103	3,608	.	1,546	161	13,142
British Honduras	.	.	.	.	350	571	434	108	1,376	431	1,374
Dominion of Canada—											
N.S., N.B., etc.	319	9,366	13	111,000	2,550	5,602	9,900	5,441	13,236	7,171	96,663
Que., Ont., Man., etc.	22,844	248,489	86	283,800	26,962	131,310	86,760	78,710	135,051	43,277	2,097,635
British Columbia	.	4,228	1	2,600	9,424	21,176	13,172	781	10,439	4,400	222,883
Newf'dl'd and Labrador	.	.	.	.	950	5,945	399	.	4,369	4,475	9,523
Central American States—											
Costa Rica	.	4,981	1	4,500	3,818	487	929	3,773	4,706	127	92,421
Guatemala	.	522	.	.	.	8,807	1,480	.	2,579	818	33,204
Honduras	.	535	.	.	.	160	233	122	5,054	239	10,574
Nicaragua	475	.	.	.	480	9,090	4,556	.	3,907	260	20,775
Salvador	.	.	.	.	949	1,262	1,226	240	2,690	565	30,589
Mexico	13,811	131,730	59	432,851	61,049	126,517	85,725	24,056	270,592	45,824	3,479,066
Miquelon, Langley, etc.	.	.	.	.	225	225	125	.	373	75	2,200
West Indies—British	116	54,247	6	33,645	4,732	6,973	8,013	2,500	17,365	5,081	89,436
Cuba	4,401	5,825	10	52,376	8,048	64,189	22,128	11,284	12,323	19,769	260,157
Danish	.	.	.	.	175	551	3,936	.	470	.	8,828
Dutch	.	126	.	.	745	26	932	.	1,142	212	3,176
French	.	.	.	.	.	.	206	.	699	103	989
Haiti	.	.	1	2,386	.	8,076	881	301	952	179	7,834
Puerto Rico	.	3,715	.	.	2,270	3,126	3,877	1,199	4,086	4,229	66,856
San Domingo	.	2,360	3	14,980	.	10,563	4,217	88	2,373	208	95,015
Argentina	1,030	114,733	3	4,200	31,566	40,919	48,400	337	143,893	31,164	315,108
Bolivia	.	.	.	.	.	.	.	325	798	1,186	2,122
Brazil	7,797	77,777	20	182,192	18,508	69,030	17,808	3,617	112,398	6,135	165,694
Chile	2,647	4,568	1	6,400	975	5,808	3,158	1,288	13,194	13,459	67,422
Colombia	1,847	3,039	8	22,886	2,586	10,436	6,872	2,776	69,374	3,942	77,776
Ecuador	.	.	1	4,919	100	1,587	1,464	3,859	31,969	1,989	33,687
Guianas—British	55	915	.	.	.	7,290	3,117	.	3,074	1,747	3,147
Dutch	343	1,074	.	.	.	2,654	426	.	374	.	29,352
French	.	.	.	.	750	50	.	.	809	.	174
Paraguay	.	.	2	8,800	.	.	.	.	480	.	280
Peru	2,240	10,696	1	3,595	7,050	13,431	8,358	5,978	40,869	4,552	131,405
Uruguay	.	739	.	.	1,024	.	1,165	.	15,532	1,308	13,461
Venezuela	244	1,270	1	3,500	2,099	4,975	2,753	1,445	20,200	1,740	131,196
Aden	.	.	.	.	.	.	185	.	40	70	56
China	893	17,548	61	732,212	8,411	71,784	24,557	470	4,544	5,799	108,968
East Indies—British	7,003	13,929	36	408,950	3,231	6,172	30,820	380	7,818	12,981	116,070
Dutch	30,491	189	2	4,030	.	.	10,711	.	601	967	59,885
French	.	.	.	.	.	.	480	.	1,046	.	4,415
Hongkong	5,932	675	.	.	.	.	2,272	512	7,051	2,647	26,347
Japan	22,495	86,904	69	529,514	13,838	31,281	29,887	185	5,270	7,262	377,829
Korea	.	6,22	3	18,000	.	.	651	.	.	.	17,292
Russia, Asiastic	.	3,268	37	480,875	9,383	112,363	5,654	.	280	2,574	42,644
Turkey in Asia	.	.	.	.	.	.	2,648	.	1,407	153	1,293
Aukland, Fiji, etc	.	.	.	.	.	.	2,600	.	.	.	1,624
British Australasia	18,751	58,374	.	.	26,755	37,764	127,268	148,424	321,785	77,285	863,540
French Oceania	.	.	.	.	.	.	772	.	2,467	.	5,054
German Oceania	.	.	.	.	.	.	.	.	.	.	.
Hawaiian Islands	.	.	3	17,686	1,517	109,320	206,489	2,550	29,132	7,893	1,244,281
Philippine Islands	.	.	.	.	.	.	76	.	126	2,836	3,037
Tonga, Samoa, etc.	.	.	.	.	.	.	108	.	165	100	795
British Africa	2,828	139,855	2	6,900	2,497	34,302	180,108	1,814	9,743	30,832	1,265,143
Canary Islands	.	575	.	.	.	.	34	.	850	.	84
French Africa	.	5,971	.	.	.	.	607	.	59	.	44,290
Liberia	.	.	.	.	.	102	.	2,087	99	.	.
Portuguese Africa	.	.	1	664	850	1,125	2,941	72	523	649	24,383
Turkey in Africa—Egypt	.	30,451	8	75,434	3,600	8,926	2,761	.	711	146	5,192
Tripoli	.	.	.	.	.	.	200	.	.	.	.
To'ls (inc. few mis. countries)	6,491,586	2,736,110	517	4,728,748	335,061	1,132,489	2,710,654	847,006	3,264,344	2,449,205	18,722,251

United States Exports of Machinery for the Fiscal Year ending June 30, 1899, Shown according to Countries.

	APRIL—				TEN MONTHS ENDING APRIL—					
	1899		1900		1898		1899		1900	
	Quantities	Values.	Quantities	Values.	Quantities	Values.	Quantities	Values.	Quantities	Values.
		Dollars.		*Dollars.*		*Dollars.*		*Dollars.*		*Dollars.*
Cash Registers	....	(*b*)	....	70,955	....	(*b*)	....	(*b*)	.....	684,224
Electrical	....	195,955	....	389,608	....	1,702,812	....	2,276,694	.....	3,295,639
Laundry Machinery	....	(*b*)	....	41,643	....	(*b*)	....	(*b*)	.....	343,007
Metal Working	....	578,151	....	612,287	....	3,703,173	....	5,410,720	.....	6,001,731
Printing Presses, and parts of	....	107,617	....	89,142	....	762,945	....	696,868	.....	1,001,443
Pumps and Pumping Machinery	....	255,229	....	263,184	....	1,667,734	....	2,229,236	.....	2,614,244
Sewing Machines, and parts of	....	339,354	....	394,322	....	2,468,920	....	2,621,687	.....	3,722,670
Shoe Machinery	....	47,614	....	122,238	....	722,274	....	711,706	.....	1,007,434
Steam Engines, and parts of—										
Fire	....	.....	....	.....	5	1,689	1	260	1	8,135
Locomotive	42	365,545	57	709,841	366	2,983,082	414	3,798,219	451	4,805,375
Stationary	59	42,666	186	56,800	475	355,458	416	257,097	1,007	520,137
Parts of, and Boilers	.. .	95,574	....	197,142	....	726,470	....	961,071	.....	1,433,048
Typewriting Machines, and parts of	....	281,674	....	259,283	....	1,547,220	....	1,965,753	.....	2,257,872
All other machinery, etc	....	1,776,434	....	1,852,116	....	10,762,668	....	15,498,038	.....	17,797,291

(*b*) Included in "all other machinery" prior to July 1899.

MACHINERY EXPORTS FOR APRIL.

$44,285,363. This must not, however, be taken as complete, for the official statisticians only record such items as they are able to, and many probably escaped them because marked with some such ambiguous designation as "manufactures of iron."

MISCELLANEOUS.

The tariff of Guatemala will be reduced 30 per cent. on merchandise imported from July 1 to December 31, 1900.

Machinery for a waterworks system for the French concession at Shanghai, China, will be awarded on bids received up to September 1. It would probably be best to address for particulars the Office national du Commerce extérieur, at Paris.

The English consul in Jerusalem reports that petroleum motors are beginning to be used in Palestine to raise water from deep wells and irrigate the orange plantations. These are to replace the mules, of which four, six or eight are employed to turn water wheels on some of the larger plantations. Several of these motors have already been imported by German firms.

While coal is scarce in Europe, there is a favorable opportunity for the introduction of American turbines. Consul Hugfies writes from Coburg of the water power that is running to waste in Southern Germany, especially in Thuringia. Only old-fashioned water wheels are known in the region.

A syndicate of Anglo-German capitalists presented to the Turkish Government a demand for concessions for floating dry docks at San Stefano or at Phanaraki. The Minister of the Marine rejected the proposition because the enterprise was a private one. It was said, however, that he would order abroad three large floating docks, one to be located at the Golden Horn, the others on the Upper Bosphorus. It may be inferred from this that the Turkish Government is in the market for shipyard tools.

Of the machinery imported into Germany in 1899 the proportions that came from the United States were as follows: Mainly of wood, one-fourth; mainly of cast iron, one-third; mainly of wrought iron, one-fifth, and mainly of metal other than iron, one-seventh. The Weights in tons were as follows:

	Total importations.	From the United States.
Mainly of wood	13,660,460	3,390,800
Mainly of cast iron	139,189,160	47,593,700
Mainly of wrought iron	30,949,820	5,968,160
Mainly of metal other than iron	910,800	125,400

Imports of sewing machines are not included in these figures.

The German papers have found out that there is a great demand in Japan for drilling and planing and screw-cutting machines and lathes, as well as for leather and rubber belts, and boilers, especially tubular. Consul Monaghan, at Chemnitz, transmits this piece of news, which should incite American tool builders to try to get the start of their wily German competitors in the Japanese market. Another mare's nest which the Germans are discovering

(*Continued on page* 48.)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 22.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Dies & punches. Amer. Hdw. Co., Ottawa, Ill.

Wanted—Patterns and drawings for good gas engine. Address K., care AMER. MACH.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

For Sale—Bicycle and general repair shop and sporting goods store, well equipped, run by power, in southern Vermont; established 13 years. Address Box 107, AMER. MACH.

For $50—Friction clutch pulley, steel rim, 54 in. diam., 10½ in. face, 2 7-16 in. bore; almost new; original cost, $114. Address postal to L. W. Pond Machine Co., Worcester, Mass.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

A successful machine-shop foreman is open for engagement. Box 71, AMER. MACHINIST.

First-class mechanical draftsman wants to change position. N., care AMER. MACHINIST.

Draftsman and designer, several years' experience; technical graduate. Box 101, AM. M.

Patternmaker, capable taking charge small shop, desires change. Box 111, AMER. MACH.

Up-to-date machine-shop foreman wants position; good manager of men. Box 106, AMERICAN MACHINIST.

Mechanic wishes engagement, either with inventor or a foreman in small shop. Box 112, AMERICAN MACHINIST.

A successful machine-shop foreman is open for engagement; best of references; city or country. J. C., AMERICAN MACHINIST.

Draftsman wants position; considerable experience in marine, sugar-house work, etc.; Swede. Box 104, AMERICAN MACHINIST.

Toolmaker and general machinist wants situation, 7 years' experience; best references. Address Box 105, AMER. MACHINIST.

A factory superintendent, technical machinist, 37, wishes to correspond with parties needing such a man. Box 99, AMER. MACH.

First-class mechanic on scientific and experimental instruments desires position; will go out of town. L. S., AMERICAN MACHINIST.

Superintendent, with 20 years' experience in light metal manufacturing of interchangeable parts, wishes to make a change. Box 86, AMERICAN MACHINIST.

Situation wanted by tool and die maker, accustomed to interchangeable work; expert in hardening; city or country. Address Box 82, AMERICAN MACHINIST.

Office position or draftsman; technical graduate, 7 years' experience in office, shop and drawing room; gas engine shop preferred. Box 102, AMERICAN MACHINIST.

A practical foreman and superintendent, with 25 years of experience in engines, dynamos and general machine-shop work, desirous of position. Address Box 85, AMER. MACH.

Experienced toolmaker on hand and automatic screw machine tools, capable of taking charge, wishes to make a change; best of references. Box 110, AMERICAN MACHINIST.

Experienced toolmaker, who has recently lost left hand, wishes position as inspector or in charge of work; thoroughly competent and can give best references. Box 95, AM. MACH.

Foreman, competent to design special machinery and tools for manufacturing purposes, wants to change; technical education and a thorough mechanic. Box 103, A. MACH.

Wanted—Position as foreman, by up-to-date machinist and toolmaker; American; temperate; age 35; experienced; best of references. Box 113, AMERICAN MACHINIST.

Wanted—Position as superintendent; long years' experience in machine shop and foundry; can design new tools, handle help to advantage; age 36; married; sober; can invest small capital. J. R., AMER. MACHINIST.

Designer automatic machinery, inventive ability, 8 years' experience intricate designing and supervising shop work, technical graduate '92, desires position to work up inventions or as head draftsman; N. Y. City preferred. Box 109, AMERICAN MACHINIST.

Toolmaker and machinist of ability and long experience wishes position, preferably as foreman or superintendent; expert on labor-saving tools and up-to-the-minute methods of doing things; good draftsman; accustomed to handling men on first-class work so as to get quick results at small cost. Box 100, AMERICAN MACHINIST.

Wanted.—Two young men, one with ability as inventor and designer of complicated automatic machinery, competent to superintend works, the other with ability as toolmaker and foreman, acquainted with modern methods of getting out work, wish to work together in the capacity of superintendent and foreman; both have experience in handling men. Address Box 88, AMERICAN MACHINIST.

(*Continued on page* 48.)

(*Continued from page 47.*)

is the market for gas motors and for mining machinery in Greece. The consul writes that catalogs printed in French would, if sent, be very advantageous there.

The total length of electric roads in Germany is now given at 1,274 miles, the increases for the past year having been: Mileage, 45 per cent.; available power, 57 per cent., and accumulator capacity, 164 per cent. The accumulators now amount to one-fourth of the dynamo power, though the pure accumulator lines are very few. The gas tramway line at Dessau, which was considered so successful, is to go over to electricity this summer.

The trust-forming mania is not confined to the United States. From Austria it is reported that the prevailing tendency there is to consolidate in every branch of industry, with a view to reducing cost of production, controlling prices to a certain extent and obtaining larger profits for the manufacturer. In Germany powerful syndicates have been formed among the coal and iron trades, the six chief ones of the latter industry being the pig iron, ingot and billet steel, girder, wire rod, plate, and drawn wire syndicates. The associated companies, as a rule, are apportioned their orders by a central managing committee. Blank acceptances are deposited with the committee by the members in order to secure the fulfillment of their mutual obligations. A syndicate formed in printing paper has occasioned an agreement among the German newspapers, it is said, to erect a paper mill themselves.

New Catalogs.

The Bristol Company, Waterbury, Conn., sends a copy of its latest partial list of recording instruments. There are included here 208 varieties of these gages and meters for pressure, temperature and electricity. Size, 8¾x11 inches.

The Construction Liegeoise d'Automobiles (Societe Anonyme), 83 and 85 Rue Lairesse, Liege, Belgium, sends us a pamphlet, in French, describing the Duryea automobile, of which this company has acquired the Belgian patents. Size, 5½x8 inches.

The Felt & Tarrant Manufacturing Company, 52-56 Illinois street, Chicago, maker of the Comptometer calculating machine, sends us a catalog, 4½x6 inches, and a 5¼x7¾-inch pamphlet, entitled "Time Is Money," setting forth the usefulness of that machine.

We have received from the Noye Manufacturing Company, Buffalo, N. Y., a catalog of the Niagara motor for launches and carriages. For launch purposes it is a two-cycle hydrocarbon engine, while for carriages a special four-cycle one is made also. Size, 4x8 inches.

The Barschall Impregnating Company, 31 Nassau street, N. Y., has published a pamphlet treating of wood preservation, with special reference to a new German process under the Hasselmann patents, which system the company is prepared to apply. Size, 4½x6½ inches.

We have received from the Chicago Pneumatic Tool Company a catalog in parallel versions of English, French and German, pre-

(*Continued on page 49.*)

Help Wanted.

Wanted—A first-class draftsman on engine work. Address The Ball & Wood Co., Elizabeth, N. J.

Wanted—Someone capable of designing good gas engine during spare hours. Address F., care AMERICAN MACHINIST.

Wanted—Good machinists; applicants will please state what their experience has been and wages expected. American Ship Windlass Co., Providence, R. I.

Draftsmen, machinists, toolmakers, desiring extra money, state where employed, confidential. Edwin Guthrie, Corcoran Building, Washington, D. C.

Want, immediately, first-class brass molder; one competent to mix and melt his own compositions. Apply to The Jenckes Machine Co., Sherbrooke, Que., Canada.

Foundry foreman; one who can take charge of 150 men and produce results; state experience, salary wanted and age. Address "Ohio," care AMERICAN MACHINIST.

Wanted, at Once—Foreman of wide experience for machine shop producing large direct-current dynamos and motors; good salary for the proper person. Box 78, AMER. MACH.

Expert layer-out for boiler shop; one accustomed to laying out intricate work from blueprints. Address, giving, age, experience and salary expected, L. O., care AM. MACH.

Wanted—A first-class Corliss Engine man; one who is familiar with the adjustment of Corliss gears and governors; technical man preferred; state experience. Box 75, AM. M.

Experienced draftsman wanted on mill machinery and machine tools; permanent employment assured to rapid and accurate draftsman. Bethlehem Steel Co., South Bethlehem, Pa.

Wanted, at Once—Foreman of wide experience for winding department of factory producing large direct-current dynamos and motors; good salary for the proper person. Box 79, AMERICAN MACHINIST.

Foreman toolmaker; New England shop employing 250 men, including 6 to 10 toolmakers; manufacturing engines and machinery; give experience, references and pay expected. Box 97, AMERICAN MACHINIST.

Wanted—Man to take charge of die department, who is experienced in handling men and in the construction of sheet metal working dies, by a concern in large town in western New York. Address "Folsom," care AM. M.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—Wideawake, systematic young foreman patternmaker for shop employing 10 patternmakers; old-established works in central Ohio making heavy machinery. Address, stating age, experience, salary wanted, Box 108, AMERICAN MACHINIST.

(*Continued on page 49.*)

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66 SENECA STREET,
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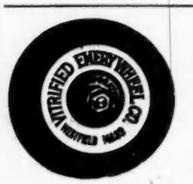

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